HAZARD RANKING SYSTEM (HRS) DOCUMENTATION RECORD COVER SHEET

Name of Site: Smokey Mountain Smelters

EPA ID No.: TND098071061

Contact Persons

Documentation Record:

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Pathways, Components, or Threats Not Scored

The ground water migration, soil exposure, and air migration pathways were not scored in this Hazard Ranking System (HRS) documentation record because they are not expected to significantly contribute to the overall score. Also, the environmental threat of the surface water migration pathway was not scored because it is not expected to significantly contribute to the overall site score.

Ground Water Migration Pathway: Private drinking water wells are located in the vicinity of the Smokey Mountain Smelters (SMS) property. In 2009, samples were collected from eight private drinking water wells located downgradient of the SMS property. One sample, SMS-09-PW, contained polychlorinated biphenyls at a concentration exceeding the EPA maximum contaminant level of 0.5 micrograms per liter (Reference [Ref.] 55, Appendix A, Figure 4, p. A-4; 55, Appendix B, Table 1A, p. B-1 and Table 2, pp. B-7, B-8, B-9). This well is located about 0.38 mile south of the SMS property (Ref. 55, Appendix A, Figure 4, p. A-4). No other samples indicated the presence of hazardous substances that have been attributed to past activities at the SMS facility (Ref. 55, Appendix B, Table 1A, p. B-1 and Table 2, pp. B-7, B-8, B-9).

Soil Exposure Pathway: An apartment complex is located to the east of the SMS property (Refs. 3; 6, p. 12, 13; 55, p. 4). In 2009, surface soil samples were collected from the apartment complex property. The samples did not contain hazardous substances at concentrations exceeding their respective minimum reporting limits (Ref. 55, Appendix B, Table 1B, pp. B-2, B-3 and Table 3, pp. B-10, B-11, B-12).

Air Migration Pathway: No air samples have been collected at the SMS property (Refs. 4; 5; 55, pp. 3, 4).

HAZARD RANKING SYSTEM (HRS) DOCUMENTATION RECORD

Name of Site:	Smokey Mountain Smelters
EPA Region:	4
Date Prepared:	March 2010
Street Address of Site*:	1508 Maryville Pike
City, County, State:	Knoxville, Knox County, Tennessee, 37920
General Location in the State:	South of the City of Knoxville
Topographic Map:	Knoxville, Tennessee, 1979
Latitude:	35º 55' 10" North
Longitude:	83º 55' 33" West

The coordinates for the Smokey Mountain Smelters facility were measured from the northeastern corner of the process building on the property (Refs. 12; 55, Appendix A, Figure 2, p. A-2).

* The street address, coordinates, and contaminant locations presented in this HRS documentation record identify the general area the site is located. They represent one or more locations EPA considers to be part of the site based on the screening information EPA used to evaluate the site for NPL listing. EPA lists national priorities among the known "releases or threatened releases" of hazardous substances; thus, the focus is on the release, not precisely delineated boundaries. A site is defined as where a hazardous substance has been "deposited, stored, placed, or otherwise come to be located." Generally, HRS scoring and the subsequent listing of a release merely represent the initial determination that a certain area may need to be addressed under the CERCLA. Accordingly, EPA contemplates that the preliminary description of facility boundaries at the time of scoring will be refined as more information is developed as to where the contamination has come to be located.

Migration Pathway	**Pathway Score**
Ground Water Migration Pathway	NS
Surface Water Migration Pathway	100.00
Soil Exposure Pathway	NS
Air Migration Pathway	NS
HRS SITE SCORE	**50.00**

Note:

NS Not scored

WORKSHEET FOR COMPUTING HRS SITE SCORE

	S Pathway	S^2 Pathway
Ground Water Migration Pathway Score (S_{gw})	Not Scored	Not Scored
Surface Water Migration Pathway Score (S_{sw})	100	10,000
Soil Exposure Pathway Score (S_s)	Not Scored	Not Scored
Air Migration Pathway Score (S_a)	Not Scored	Not Scored
$S^2_{gw} + S^2_{sw} + S^2_s + S^2_a$		10,000
$(S^2_{gw} + S^2_{sw} + S^2_s + S^2_a) / 4$		2,500
$\sqrt{(S^2_{gw} + S^2_{sw} + S^2_s + S^2_a) / 4}$		**50.00**

Note:

NS Not scored

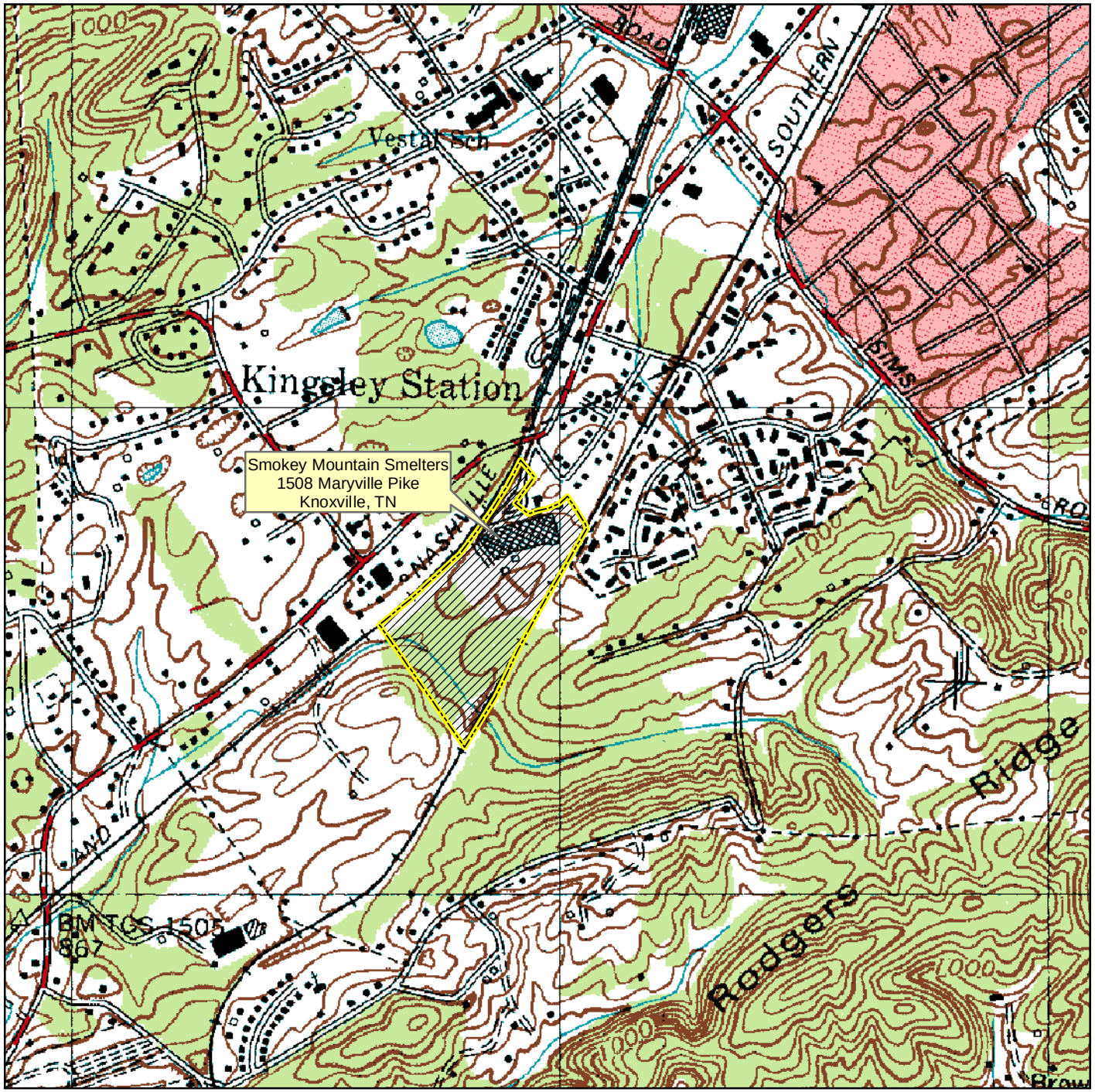
Table 4-1 –Surface Water Overland/Flood Migration Component Scoresheet			
Factor Categories and Factors	**Maximum Value**	**Value Assigned**	
Drinking Water Threat			
Likelihood of Release:			
1. Observed Release	550	550	
2. Potential to Release by Overland Flow:			
2a. Containment	10		
2b. Runoff	25		
2c. Distance to Surface Water	25		
2d. Potential to Release by Overland Flow [lines 2a(2b + 2c)]	500		
3.Potential to Release by Flood:			
3a. Containment (Flood)	10		
3b. Flood Frequency	50		
3c. Potential to Release by Flood (lines 3a x 3b)	500		
4. Potential to Release (lines 2d + 3c, subject to a maximum of 500)	500		
5. Likelihood of Release (higher of lines 1 and 4)	550		550
Waste Characteristics:			
6. Toxicity/Persistence	[a]	10,000	
7. Hazardous Waste Quantity	[a]	10,000	
8. Waste Characteristics	100		100
Targets:			
9. Nearest Intake	50		
10. Population:			
10a. Level I Concentrations	[b]		
10b. Level II Concentrations	[b]		
10c. Potential Contamination	[b]		
10d. Population (lines 10a + 10b + 10c)	[b]		
11. Resources	5	5	
12. Targets (lines 9 + 10d + 11)	[b]		5
Drinking Water Threat Score:			
13. Drinking Water Threat Score [(lines 5x8x12)/82,500, subject to a maximum of 100]	100		3.33
Human Food Chain Threat			
Likelihood of Release:			
14. Likelihood of Release (same value as line 5)	550		550
Waste Characteristics:			
15. Toxicity/Persistence/Bioaccumulation	[a]	500,000,000	
16. Hazardous Waste Quantity	[a]	10,000	
17. Waste Characteristics	1,000		1,000
Targets:			
18. Food Chain Individual	50	20	

Table 4-1 –Surface Water Overland/Flood Migration Component Scoresheet (Continued)

Factor Categories and Factors	Maximum Value	Value Assigned	
19. Population			
19a. Level I Concentrations	[b]		
19b. Level II Concentrations	[b]		
19c. Potential Human Food Chain Contamination	[b]	0.0000003	
19d. Population (lines 19a + 19b + 19c)	[b]		0.0000003
20. Targets (lines 18 + 19d)	[b]		20.0000003
Human Food Chain Threat Score:			
21. Human Food Chain Threat Score [(lines 14x17x20)/82500, subject to maximum of 100]	100		100
Environmental Threat			
Likelihood of Release:			
22. Likelihood of Release (same value as line 5)	550		550
Waste Characteristics:			
23. Ecosystem Toxicity/Persistence/Bioaccumulation	[a]	NS	
24. Hazardous Waste Quantity	[a]	NS	
25. Waste Characteristics	1,000		NS
Targets:			
26. Sensitive Environments			
26a. Level I Concentrations	[b]	NS	
26b. Level II Concentrations	[b]	NS	
26c. Potential Contamination	[b]	NS	
26d. Sensitive Environments (lines 26a + 26b + 26c)	[b]	NS	
27. Targets (value from line 26d)	[b]		NS
Environmental Threat Score:			
28. Environmental Threat Score [(lines 22x25x27)/82,500 subject to a maximum of 60]	60		NS
Surface Water Overland/Flood Migration Component Score for a Watershed			
29. Watershed Score[c] (lines 13+21+28, subject to a maximum of 100)	100		100
Surface Water Overland/Flood Migration Component Score			
30. Component Score (S_{sw})[c] (highest score from line 29 for all watersheds evaluated; subject to a maximum of 100)		100.00	100.00

Notes:

[a] Maximum value applies to waste characteristics category
[b] Maximum value not applicable
[c] Do not round to nearest integer
NS Not Scored



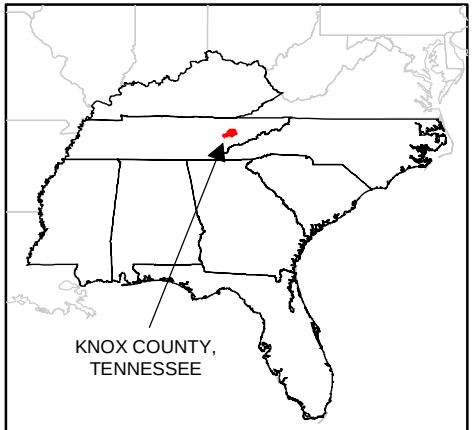
LEGEND

Approximate Property Boundary

0 500 1,000 Feet

1:12,000

Map Source:
USGS, KNOXVILLE, TN Topographic Quadrangle, 1979
The property boundary was obtained from the KGIS geographic Information System website at:
http://www.kgis.org/KnoxNetWhere/viewer.asp



United States Environmental Protection Agency

SMOKEY MOUNTAIN SMELTERS
KNOXVILLE,
KNOX COUNTY,
TENNESSEE
TDD No.TTEMI-05-003-0001

FIGURE 1
FACILITY LOCATION

TETRA TECH

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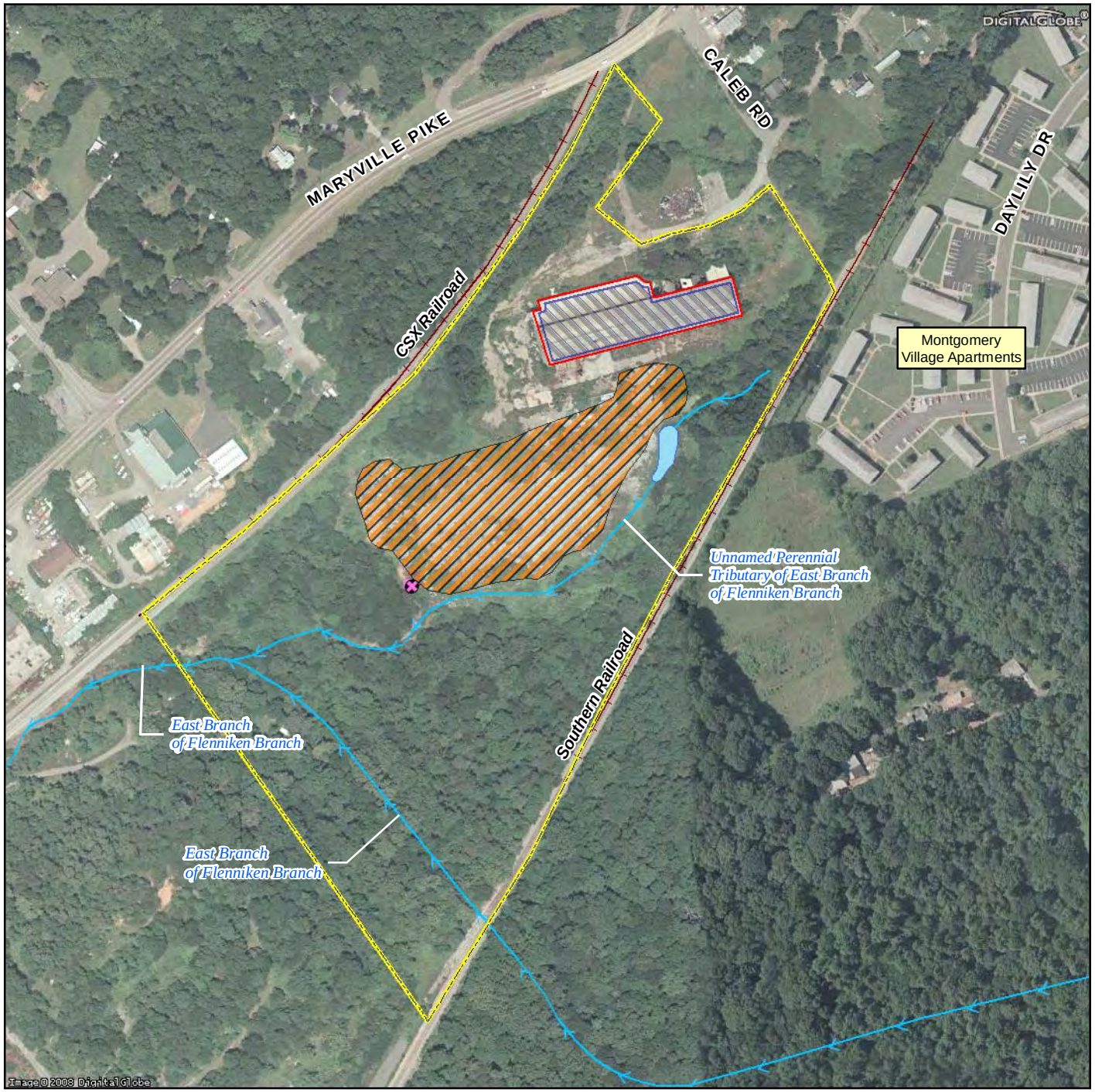

LEGEND

- Source No. 1 Exterior Waste Pile
- Leachate Seep from Source No. 1
- Source No. 2 Interior Waste Piles
- Process Building
- Approximate Property Boundary
- Railroad Tracks
- Pond
- Surface Water Body

0 150 300 Feet

1:3,600

Map Sources:
References 4, 39, 46, 55
Aerial Photo, Digital Globe 2000

United States Environmental Protection Agency

SMOKEY MOUNTAIN SMELTERS
KNOXVILLE,
KNOX COUNTY,
TENNESSEE
TDD No.TTEMI-05-003-0001

FIGURE 2
FACILITY LAYOUT
AND SOURCE LOCATIONS

TETRA TECH

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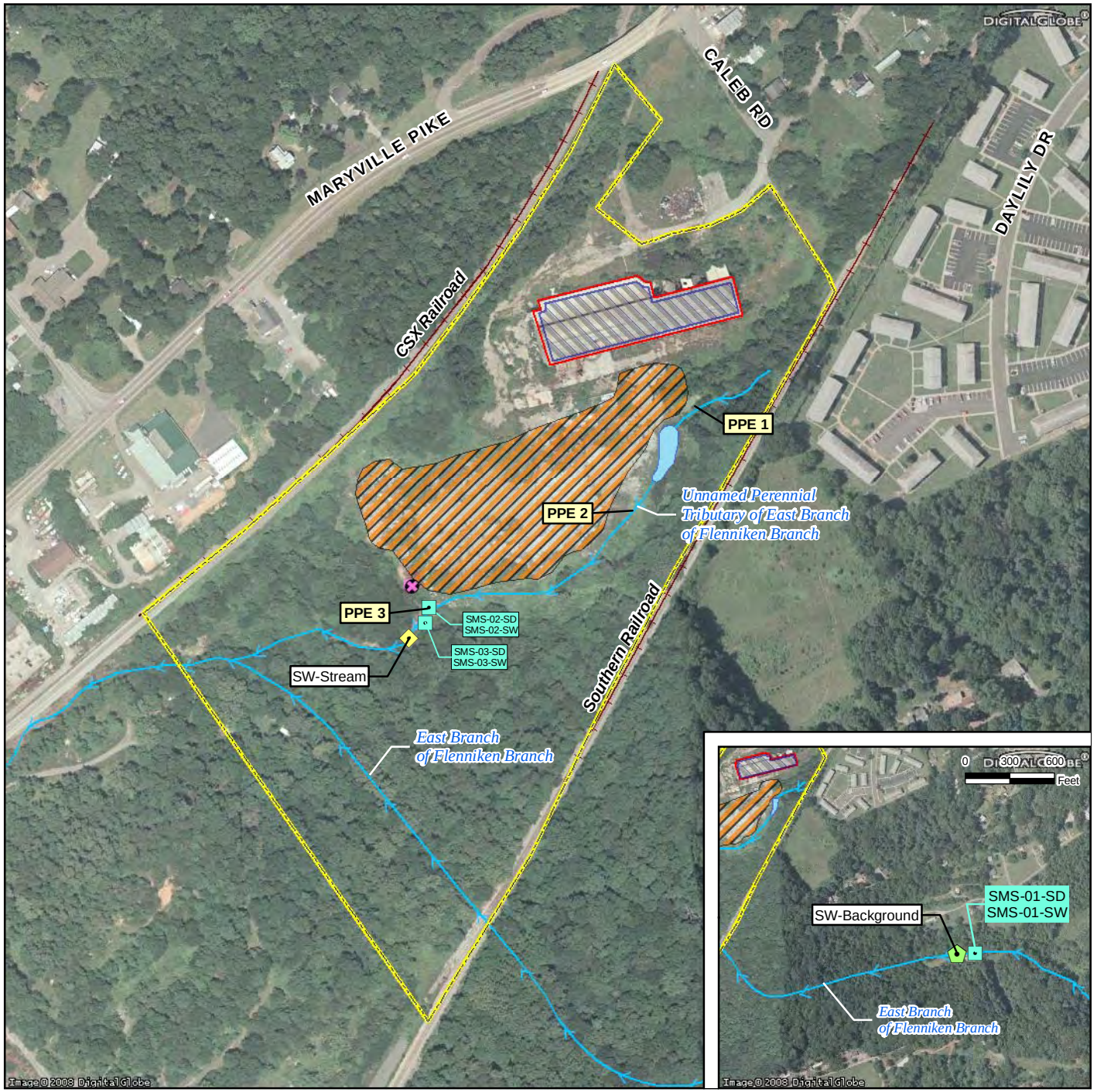

LEGEND

START and REAC Sample Locations

- 2009 Sediment and Surface Water

REAC Sample Locations

- 2006 SW-Background
- 2006 SW-Stream
- Source No. 1 Exterior Waste Pile
- Leachate Seep from Source No. 1
- Source No. 2 Interior Waste Piles
- Process Building
- Approximate Property Boundary
- Railroad Tracks
- Pond
- Surface Water Body

0 150 300 Feet

1:3,600

Notes:
PPE - Probable Point of Entry
REAC – Response Engineering and Analytical Contract
SD - Sediment
SMS - Smokey Mountain Smelters
START – Superfund Technical Assessment and Response Team
SW - Surface water

Map Sources
(Reference 4, 46, 55).
Aerial Photo, Digital Globe 2000.

United States Environmental Protection Agency

SMOKEY MOUNTAIN SMELTERS
KNOXVILLE,
KNOX COUNTY,
TENNESSEE
TDD No.TTEMI-05-003-0001

FIGURE 3
SURFACE WATER SAMPLES

TETRA TECH

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77. Tetra Tech. Project Note with Attachments. Subject: Volume of the Exterior Waste Pile – Source No. 1. Attachments: Boring Logs from December 2006, On-Site Sampling Locations Figure, Logbook Notes. October 28, 2009. 20 Pages.

78. REAC. Trip Report – Multi-Media Sampling, Smokey Mountain Smelter Site, Knoxville, Tennessee, Work Assignment #0-182. October 23, 2009. 35 Pages.

79. TDEC, DOR. Project Note to File. Subject: Depths of On-site Perennial Tributary and East Branch of Flenniken Branch. January 26, 2010. 1 Page.

80. TDEC, DOR. Project Note to File with Attachment. Subject: Fishery Evidence. Attachment: Photographs. January 29, 2010. 9 Pages.

81. EPA. Contract Laboratory Program (CLP) Statement of Work for Inorganic Analysis, Multi-Media, Multi-Concentration, ILM05.3 to ILM05.4, Summary of Changes, December 1, 2006 and ILM05.3, March 2004. Accessed On-line at http://www.epa.gov/superfund/programs/clp/ilm5.htm. 98 Pages.

82. EPA. *Using Qualified Data to Document an Observed Release and Observed Contamination*. November 1996. 18 Pages.

SITE DESCRIPTION

Smokey Mountain Smelters (SMS) is located at 1508 Maryville Pike, Knoxville, Knox County, Tennessee, in the eastern portion of the State (Ref. 7). 1455 (Old) Maryville Pike is sometimes listed as an alternate address for the SMS facility (Refs. 7, pp. 1, 6 through 9; 32, p. 1; 49, p. 1). Specifically, the geographic coordinates for SMS, as measured from the northeastern corner of the process building, are latitude 35º 55' 10" north and longitude 83º 55' 33" west (Refs. 12; 55, Appendix A, Figure 2, p. A-2). The U.S. Environmental Protection Agency (EPA) identification number, as recorded in the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) database, is TND098071061 (Ref. 51, p. 4). Based on Knox County, Tennessee property parcel information, the SMS property covers about 23.9 acres (Ref. 7, pp. 1, 3, 4, 5). The SMS property is surrounded by mixed residential and commercial properties to the north, an undeveloped wooded area to the south, an apartment complex to the east, and mixed residential and commercial properties to the west (Refs. 3; 7, pp. 1, 3, 4, 5; 55, Appendix A, Figure 2, p. A-2) (see Figures 1 and 2 of this HRS documentation record).

During numerous inspections (beginning in 1997) conducted by the Tennessee Department of Environmental Conservation (TDEC) (formerly Tennessee Department of Conservation [TDOC] and Tennessee Department of Health and Environmental Conservation [TDHEC]), it was determined that the SMS property contained a large metal industrial process building and numerous gray colored waste piles which covered most of the southern portion of the SMS property (Refs. 5, pp. i, ii, 3; 76, pp. 1, 2). The process building contained two natural gas-fired rotary furnaces, one casting furnace, and a large overhead crane. Large air ducts led to two baghouses located near the southwestern corner of the process building. Other areas on the property included a small transformer area, a burned office building with truck scales, railroad tracks, a maintenance building, and a pond (lagoon) (Ref. 5, pp. 3, 413). Currently, the SMS property consists of a dilapidated process building, a large waste pile, and a pond (see Figure 2 of this documentation record; Refs. 4, p. 33; 76; 74). The waste pile is mostly devoid of vegetation (Refs. 4, pp. 33, 56; 55, Appendix D, p. 4) (see Figure 2 of this HRS documentation record).

For HRS scoring purposes, the site consists of two sources on the SMS property and associated releases. Source No.1 includes the exterior waste pile located in the southern portion of the property (Refs. 4, p. 33; 55, pp. 1, 2, 4, 7; 55, Appendix A, Figure 2, p. A-2; 55, Appendix C, p. C-3; 55, Appendix D, pp. 4, 6). Source No. 2 includes waste piles located inside the process building (Ref. 4, pp. 1, 33, 35; 55, pp. 2, 4, 7; 55, Appendix A, Figure 2, p. A-2; 55, Appendix C, pp. C-1, C-2; 55, Appendix D, pp. 4, 24) (see Figure 2 of this HRS documentation record). Source No. 1 consists of secondary aluminum smelting waste with a mostly gray, fine, silty texture (Refs. 4, p. 56; 46; 55, p. 4; 55, Appendix B, Table 1C, p. B-4). Source No. 2 consists of gray material (primary aluminum smelter waste), similar in appearance to the waste contained in Source No. 1 (Refs. 4, p. 1; 46; 55, p. 4; 55, Appendix B, Table 1C, p. B-4). The smelter waste is the result of aluminum smelting operations that occurred on the SMS property (Refs. 5, p. 3; 49). Samples collected from Source Nos. 1 and 2 contain hazardous substances including metals, semivolatile organic compounds (SVOCs), volatile organic compounds (VOCs), and polychlorinated biphenyls (PCBs) (see Section 2.2 of this HRS documentation record). Analytical results of surface water and sediment samples collected from an unnamed perennial tributary, which receives runoff from Source Nos. 1 and 2, indicate that a release of hazardous substances, including metals and VOCs, has occurred to the surface water migration pathway (see Section 4.0 of this HRS documentation record).

OPERATIONAL AND REGULATORY HISTORY

From 1922 until at least 1948, Knoxville Fertilizer Company operated a fertilizer factory on the SMS property. Structures on the property during fertilizer operations included: a sulfuric acid tank, 30,000-gallon water tank, 70,000-gallon reservoir, and nitre house (Refs. 5, p. 4; 30, p. 1; 64). U.S. patents written by assignors to Knoxville Fertilizer Company describe the production processes for phosphatic

and ammonium sulphate fertilizers. Both of these fertilizers utilize acid phosphate (super-phosphate) (Refs. 10, p. 1; 11). Manufacturing of phosphate fertilizer produces wastewater which may contain heavy metals including cadmium, mercury, and lead (Ref. 29, p. 6). Drainage from stockpiles of gypsum may contain heavy metals (cadmium, mercury, and lead), fluorides, and phosphoric acid (Ref. 29, p. 5). Knox County tax assessor information indicates that ownership of the property changed numerous times between 1948 and 1979. However, operations on the property may have continued in manufacturing agricultural products such as fertilizer (Ref. 5, pp. 4, 5).

A 1966 topographic map of the property shows two settling ponds located on the eastern portion of the property (Ref. 31, pp. 1 through 7). The purpose of the settling ponds is not known. The settling ponds appear to be in the same location as the pond currently located on the SMS property (Refs. 4, p. 33; 31, p. 1).

SMS (also known as Rotary Furnace, Inc.) was established in 1979 (Ref. 32, pp. 1 through 6). Limited information is available on the operational history at the SMS property. According to a 1985 Knox County Department of Air Pollution Control (KCDAPC) permit, an aluminum furnace (Rotary Aluminum Recovery Furnace #1) operated on the SMS property (Refs. 5, p. 5; 49). From 1983 to 1989, KCDAPC received complaints regarding open burning and heavy emissions from the facility. Numerous inspections were performed at the property and violations were issued for open burning and excessive emissions (Refs. 28; 33; 34).

In March 1983, the Tennessee Division of Solid Waste Management conducted an inspection at the SMS property regarding the operation of an unpermitted landfill/disposal area on the property (Refs. 26; 27; 35). During the inspection, the landfill (dump) contained demolition and industrial waste (slag and cinders from furnace operations). The dump also contained evidence of burning waste (Refs. 26; 35). In August 1983, the Tennessee Division of Solid Waste Management conducted a geologic evaluation at the SMS property. During the evaluation, the landfill/disposal area contained mostly impure "salt cake" resulting from processing aluminum ore (Ref. 36, p. 1). Based on the location of the landfill/disposal area and the exterior waste pile (Source No. 1), the landfill/disposal area appears to have been located in the same location as the Source No. 1 waste pile (Refs. 36, pp. 3, 4; 55, Appendix A, Figure 2) (see Figure 2 of this documentation record). Upon subsequent evaluation and observation, it appears that the landfill/disposal area consists of two different types of waste: the overlying salt cake waste pile and the underlying mixed-waste disposal area. The overlying waste pile (Source No. 1) consists of homogeneous fine gray aluminum smelter waste that is similar in appearance to the interior waste piles (Source No. 2) (Refs. 4, pp. 1, 56, 103 through 127; 46; 55, p. 4; 55, Appendix D, p. 4). This waste pile is located on top of what appears to be a mixed-waste disposal area with some evidence that backfill material may have been contemporaneously placed among the underlying mixed waste. Boring logs show that wastes in the underlying mixed-waste disposal area include smelter waste that is commingled with mixed waste including paper and wood fragments, broken white and red brick fragments, angular limestone, gravel, clay, and silty clay (Ref. 4, pp. 36, 103 through 127). For the purposes of this HRS documentation record, the overlying waste pile containing aluminum smelter waste is scored as Source 1 (see Section 2.2 of this documentation record).

During TDEC investigations in 1997, 1998, and 2002, the following wastes were observed on the SMS property: baghouse dust and dross/slag from secondary aluminum smelting and casting, as well as anode/cathode wastes and dross/slag from primary aluminum production (Refs. 5, pp. 6, 8, 9; 6, p. 4). The Aluminum Company of America (ALCOA) sent large quantities of wastes potentially containing hazardous substances to the SMS Knoxville facility between 1985 and 1992 (Ref. 37, pp. 1 to 21). The wastes included dross, filters, furnace bottoms, oily scalper chips, tabular balls, salt cake, and pot pads (Ref. 37, pp. 11 through 17, 19 to 21, 24, 26, 28, 42, 46). Also, between 1982 and 1995, Metal Exchange Corporation (MEC) sent large quantities of materials to SMS, and some of these materials are still present

on the property (Ref. 37, p. 2). MEC sent materials including dross, turnings, and aluminum pot bottoms to the SMS property (Ref. 37, pp. 2, 11, 12, 13, 14, 55, 56, 57).

Waste by-products from aluminum smelter operations include secondary aluminum, dross residues, and baghouse and furnace dusts. Baghouse dusts may contain cadmium and lead above EPA Toxicity Characteristic Leaching Procedure (TCLP) regulatory limits (Ref. 38, pp. B-14, B-15). Furnace dusts contain volatilized, elemental cadmium and mercury (Ref. 38, p. B-15).

PREVIOUS INVESTIGATIONS

In 1997 and 1998, TDEC conducted site investigations at the SMS property. Activities included collection of waste, surface water, and sediment samples (Ref. 6, pp. 4, 9, 15, 17, 18). The waste samples collected from the exterior waste pile (Source No. 1) contained cadmium, chromium, copper, and zinc (Ref. 6, pp. 15, 21). Surface water and sediment samples were collected from the East Branch of Flenniken Branch and Flenniken Branch (Refs. 6, pp. 21, 34). The surface water and/or sediment samples contained elevated concentrations of beryllium, copper, lead, zinc, benzo(a)pyrene, pyrene, and chrysene, as compared to background levels (Ref. 6, pp. 17, 18, 21).

In 2002, TDEC conducted an expanded site inspection (ESI) at the SMS property. During the ESI, TDEC collected waste, sediment, and surface water samples from the SMS property (Ref. 5, pp. 9, 11). The waste samples collected from Source No. 2 contained elevated concentrations of beryllium, chromium, copper, lead, nickel, silver, and zinc (Ref. 5, pp. 11, 12). The sediment and surface water samples contained elevated concentrations of copper (Ref. 5, pp. 25, 26, 27, 29). During the ESI, a leachate seep was observed emanating from the exterior waste pile and entering the unnamed perennial tributary of the East Branch of Flenniken Branch (Ref. 5, pp. 26, 29, 43). A sample collected from the leachate contained nickel and PCBs (Ref. 5, pp. 27, 28).

EPA directed the Response Engineering and Analytical Contract (REAC) contractor to conduct a site investigation at the SMS property, which was completed during October 2006 and December 2006 (Refs. 4, pp. 1, 2, 3). During the site investigation, REAC observed (1) a structurally unstable building (the process building) that housed rotary and casting furnaces; (2) piles of smelting waste located inside the process building; (3) used bag filters and bag filter dust located in the baghouse area adjacent to the process building; and (4) aluminum smelting waste (exterior waste pile, Source No. 1) covering the southern portion of the property (Refs. 4, p. 1) (see Figure 2 of this documentation record). The exterior waste pile contained smelter waste with a mostly gray, fine, silty texture (Ref. 4, p. 56).

During the REAC 2006 site investigation, samples were collected from the exterior waste pile (Source No. 1), a leachate sample was collected from a leachate seep emanating from the exterior waste pile, and a surface water sample was collected from the unnamed perennial tributary of the East Branch of Flenniken Branch (Refs 4, pp. 2, 3, 36) (see Figure 2 of this HRS documentation record). Borings were advanced through the exterior waste pile at depths ranging from 0 to 25 feet below land surface (bls) (Ref. 4, p. 3). Samples collected from the borings contained beryllium, cadmium, chromium, copper, lead, mercury, benzo(a)pyrene, and PCBs, among others (Refs. 4, pp. 17 through 24, 35; 68). The sample collected from the leachate emanating from the exterior waste pile contained antimony, arsenic, copper, lead, mercury, nickel, and 2-butanone (methyl ethyl ketone) (Refs. 4, pp. 26, 35, 156, 178, 326; 55, Appendix B, pp. B-16, B-17, B-18; 67). Surface water samples collected from the unnamed perennial tributary of the East Branch of Flenniken Branch contained antimony, arsenic, copper, cyanide, mercury, nickel, acetone, and 2-butanone at elevated concentrations (Ref. 4, pp. 26, 35, 155, 177, 326, 357).

In April 2009, EPA directed Tetra Tech under the Superfund Technical Assessment and Response Team (START) contract as well as REAC to conduct an integrated assessment at the SMS property (Ref. 55, p. 1). Integrated assessment activities included the collection of waste, surface and subsurface soil, surface

water, and sediment samples. Waste samples were collected from the exterior waste pile (Source No. 1), the interior waste piles (Source No. 2), and the leachate seep. Surface water and sediment samples were collected from an unnamed perennial tributary of the East Branch of Flenniken Branch (Ref. 55, p. 3; 55, Appendix A, Figure 3, p. A-3, Figure 4, p. A-4; 55, Appendix B, Tables 1B through 1E, pp. B-2 through B-6).

Samples collected from the waste piles (exterior and/or interior) contained copper (up to 2,900 milligrams per kilogram [mg/kg]), mercury (up to 0.20 mg/kg), and nickel (1,900 mg/kg) (Ref. 55, Appendix B, Table 4, pp. B-13, B-14, B-15). The waste sample collected from the leachate seep contained arsenic (9.6 micrograms per liter [µg/L]), chromium (33 µg/L), copper (290 µg/L), lead (14 µg/L), nickel (34 µg/L), and zinc (100 µg/L). The surface water samples collected from the unnamed perennial tributary of the East Branch of Flenniken Branch contained elevated concentrations of arsenic (17 µg/L), copper (up to 370 µg/L), lead (up to 12 µg/L), mercury (up to 0.25 µg/L), and zinc (87 µg/L), as compared to background levels (Ref. 55, Appendix B, Table 5, pp. B-16, B-17, B-18). The sediment samples collected from the East Branch of Flenniken Branch contained elevated concentrations of chromium (up to 160 mg/kg) and copper (up to 960 mg/kg), as compared to background levels (Ref. 55, Appendix B, Table 6, pp. B-19, B-20, B-21) (see Figure 3 of this HRS documentation record).

Waste samples collected from Source Nos. 1 and 2 contain high concentrations of aluminum, which resulted from past aluminum smelting operations at the SMS property. Aluminum was detected at concentrations ranging from 103,000 mg/kg to 217,000 mg/kg in waste samples collected from Source No. 1 in 2006 (Ref. 4, pp. 1, 36, 320 to 325). In 2009, waste samples collected from Source No. 1 contained aluminum at concentrations ranging from 130,000 mg/kg to 150,000 mg/kg (Ref. 55, Appendix E, pp. 289, 291). A waste sample collected from Source No. 2 in 2006 contained aluminum at a concentration of 158,000 mg/kg (Ref. 4, p. 325). Waste samples collected from Source No. 2 in 2009 contained aluminum at concentrations ranging from 140,000 mg/kg to 190,000 mg/kg (Ref. 55, Appendix E, pp. 297, 299).

2.2 SOURCE CHARACTERIZATION

2.2.1 SOURCE IDENTIFICATION

Number of source: 1

Name of source: Exterior Waste Pile

Source Type: Pile

Description and Location of Source (with reference to a map of the site):

Source No. 1 (exterior waste pile) is located on top of a mixed waste disposal area located in the southern portion of the SMS property (Refs. 4, pp. 36, 103 through 127; 55, Appendix A, Figure 2, p. A-2). Source No. 1 covers an area of about 3.3 acres and waste is present between 0 and 16 feet bls, with an average depth of 5 feet bls (Refs. 4, pp. 36, 103 through 127; 39; 77). Source No. 1 contains secondary aluminum smelting waste with a mostly gray, fine, silty, texture (Refs. 4, p. 56; 46; 55, Appendix D, p. 4). Limited information is available regarding the operational history of the SMS facility. The SMS facility operated an aluminum smelter on the property (Ref. 49). The exact dates of operations are not known; however, the KCDAPC received complaints regarding open burning and heavy emissions from 1983 to 1989 (Refs. 28; 33; 34).

In a lease agreement entered on October 1, 1982, Rotary Furnace was allowed to bury slurry generated by the operation of its rotary furnace on the property (Ref. 7, pp. 9, 14). Rotary Furnace operated an aluminum furnace on the property (Ref. 5, p. 5; 49). During a 1983 Tennessee Department of Health and Environment inspection, a landfill/disposal area was located in the southern portion of the SMS property. The landfill/disposal area contained slag and cinders from furnace operations, and evidence of burning waste was noted (Refs. 26; 27; 35). A 1983 Tennessee Department of Health and Environment geologic investigation report indicated that the landfill/disposal area contained “salt cake” resulting from the processing of aluminum ore (Ref. 36, p. 1).

When operations ceased at the SMS property, the smelter waste was left in place (Ref. 46). During the 2006 site investigation, borings were advanced through Source No. 1. Smelter waste was encountered at depths ranging from 0 to 16 feet bls with an average depth of 5 feet bls (Refs. 4, pp. 1, 56, 103 through 127; 77). The smelter waste consisted of a mostly gray, fine, silty texture that is similar in appearance to the interior waste piles (Source No. 2) (Refs. 4, pp. 1, 56, 103 through 127; 46; 55, p. 4; 55, Appendix D, p. 4). Smelter waste was present at deeper depths below Source No. 1; however, the smelter waste was commingled with other materials including paper and wood fragments, broken white and red brick fragments, angular limestone gravel, clay, and silty clay (Ref. 4, pp. 36, 103 through 127).

For the purposes of this evaluation, Source No. 1 consists of the aluminum smelter waste (salt cake) waste pile that was deposited on top of the mixed waste landfill/disposal area. While there is evidence of some layers of backfill material within the mixed waste disposal area underlying Source 1, there is no evidence of any contemporaneous layering of soil or other backfill within the smelter waste piled on top of the mixed waste disposal area (Ref. 4, pp. 36, 103 through 127).

The area of the waste pile is about 3.3 acres. Aerial photographs from 2000 to 2008, boring logs, and sampling log books were used to calculate the area of the waste pile by examining scarring in the images (Refs. 4, pp. 36, 103 through 127; 39; 55, Appendix D; 71). During the 2009 integrated assessment, the waste pile was not vegetated (Ref. 55, p. 4).

Table 1 provides the locations and descriptions of samples collected from Source No. 1 during the December 2006 site investigation and April 2009 integrated assessment. A list of hazardous substances associated with each sampling location also is included in Table 1.

TABLE 1: Description of Source No. 1 Samples

Sample ID	Sample Location	Sample Description	Date of Boring	Depth of Waste (bls)	Hazardous Substances	Reference
December 2006 Site Investigation						
SB-1	East side of pile, about 328 feet southwest of the southeastern corner of the process building	Greenish blue fill, 2 inches thick; gray fill; gray – silty fill, soft	12/12/2006	9 feet	beryllium, chromium, copper, lead, nickel, silver, zinc	4, pp. 36, 103, 320
SB-4	Center of pile, about 280 feet south of the southwestern corner of the process building	Fill, gray, fine sand size, powdery, dry; thin green-blue zone	12/12/2006	4 feet	arsenic, beryllium, cadmium, chromium, copper, lead, nickel, zinc	4, pp. 36, 106, 320
SB-5	Eastern side of pile, about 510 feet southwest of the southeastern corner of the process building	Fill, gray, sand size, soft; fill, gray, sand size with green specks	12/12/2006	2 feet	arsenic, beryllium, cadmium, chromium, copper, lead, nickel, zinc	4, pp. 36, 108, 321
SB-6	East side of pile, about 377 feet south of the western portion of the process building.	Fill, gray, sand size, dry with blue-green specks; fill, gray	12/12/2006	4 feet	arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, silver, zinc	4, pp. 36, 109, 321

TABLE 1: Description of Source No. 1 Samples						
Sample ID	**Sample Location**	**Sample Description**	**Date of Boring**	**Depth of Waste (bls)**	**Hazardous Substances**	**Reference**
SB-7	Southeast side of pile, about 410 feet south of the southwestern corner of the process building	Fill, gray, silt size with blue-green specks	12/12/2006	2 feet	acetone, 2-butanone, naphthalene, acenaphthene, fluorene, phenanthrene, anthracene, pyrene, chrysene, benzo(a)anthracene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, benzo(g,h,i)perylene, Aroclor-1232, Aroclor-1260, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, silver, zinc	4, pp. 36, 110, 140, 195, 276, 322
SB-8	Center of pile, about 280 feet south of the southwestern corner of the process building	Fill, gray, silt size, firm, dry	12/13/2006	4 feet	Aroclor-1232, Aroclor-1260, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, silver, zinc	4, pp. 36, 111, 276, 322
SB-9	Center of pile, about 260 feet south of the western portion of the process building	Fill, gray, silt size, moist	12/13/2006	7 feet	Aroclor-1232, arsenic, beryllium, cadmium, chromium, copper, lead, nickel, silver, zinc	4, pp. 36, 112, 196, 277, 322
SB-10	Northeast side of pile, about 245 feet south of the southwestern portion of the process building	Fill, gray, coarse sand size, dry with approximately 5 percent blue grains	12/13/2006	7 feet	beryllium, cadmium, chromium, copper, lead, nickel, zinc	4, pp. 36, 113, 277, 278, 322

TABLE 1: Description of Source No. 1 Samples						
Sample ID	**Sample Location**	**Sample Description**	**Date of Boring**	**Depth of Waste (bls)**	**Hazardous Substances**	**Reference**
SB-16	Center of pile, about 295 feet south of the southwestern corner of the process building	Fill, gray, sand-size, dry; fill, gray, medium sand size; fill, black, red, white, gray; fill, gray, sand size, moist	12/13/2006	16 feet	arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, zinc	4, pp. 36, 120, 279, 323
SB-17	North side of pile, about 200 feet south of the west corner of the process building	Fill, gray, silt-size, firm dry; fill, gray to black, moist	12/14/2006	3 feet	acetone, 2-butanone, naphthalene, phenanthrene, pyrene, butyl benzyl phthalate, chrysene, benzo(a)pyrene, arsenic, beryllium, chromium, copper, lead, nickel, silver, zinc	4, pp. 36, 122, 144, 175, 200, 281, 325
SB-18	Eastern side of pile, about 400 feet south of the southeastern corner of the process building	Fill, gray, silt-size, with blue-gray coatings	12/14/2006	5 feet	benzo(g,h,i)perylene, antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, zinc	4, pp. 36, 123, 144, 204, 281, 325
SB-20	Western side of pile, about 360 feet southwest of the western corner of the process building	Fill, gray, silt size, firm, moist; fill, brick colored, sand size with wood fragments; fill	12/14/2006	7 feet	phenanthrene, pyrene, chrysene, benzo(a)anthracene, benzo(a)pyrene, Aroclor-1232, Aroclor-1260, arsenic, beryllium, chromium, copper, lead, nickel, zinc	4, pp. 36, 125, 145, 200, 282, 325

TABLE 1: Description of Source No. 1 Samples						
Sample ID	**Sample Location**	**Sample Description**	**Date of Boring**	**Depth of Waste (bls)**	**Hazardous Substances**	**Reference**
SB-21	South side of pile, about 430 feet southwest of the southwestern corner of the process building	Fill, gray, silt size, moist	12/14/2006	3 feet	Aroclor-1232, Aroclor-1260, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, silver, zinc	4, pp. 36, 126, 282, 325
April 2009 Integrated Assessment						
SMS-01-WA	Exterior waste pile, REAC 2006 boring location SB-08, about 280 feet south of the southwestern corner of the process building	Waste, gray, dry, fine texture, no organic material	04/27/2009	2 feet	beryllium, chromium, copper, lead, nickel, selenium, zinc	55, Appendix A, Figure 3, p. A-3; 55, Appendix B, Table 1C, p. B-4; 55, Appendix D, p. 7; 55, Appendix E, pp. 215, 289
SMS-02-WA	Exterior waste pile, REAC 2006 boring location SB-07, about 410 feet south of the southwestern corner of the process building	Waste, dark black, moist, fine texture, no organic matter	04/27/2009	2 feet	chromium, copper, lead, nickel, silver, zinc	55, Appendix A, Figure 3, p. A-3; 55, Appendix B, Table 1C, p. B-4; 55, Appendix D, p. 7; 55, Appendix E, pp. 217, 291

Notes:

bls Below land surface
ID Identification
NA not applicable
REAC Response Engineering and Analytical Contract
SB Soil boring
SMS Smokey Mountain Smelters
WA Waste

2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH SOURCE NO. 1

REAC December 2006 Site Investigation – 0 to 5 feet bls

The source samples listed in Table 2 were collected from Source No. 1 (exterior waste pile) in December 2006 during the REAC site investigation. The source samples shown in Table 2 were collected at depths ranging from 0 to 5 feet bls (Ref. 4, pp. 3, 36). The samples were analyzed for target analyte list (TAL) metals and mercury, VOCs, SVOCs, and PCBs (Refs. 4, p. 3; 14, p. 2).

The metals analysis was conducted using REAC SOP 1811 (EPA SW-846 Methods 3015/3050B/6010B) and REAC SOP 1832 (EPA SW-846 Methods 7000A/7470A/7471A) (Refs. 4, p. 316; 18; 47). VOCs were analyzed using REAC SOP 1807, EPA SW-846 Methods 8000B/8260B (Refs. 4, p. 133; 15). SVOCs were analyzed using REAC SOP 1805, EPA SW-846 Methods 3500B/3541/8000B/8270C (Refs. 4, p. 187; 16). The PCBs were analyzed using REAC SOP 1809, EPA SW-846 Methods 3500B/3540C/3541/3600C/3640A/8000B/8081A (Refs. 4, p. 263; 17).

All samples were collected in accordance with the REAC Work Plan and Quality Assurance Project Plan prepared for Work Assignment No. 0-182 for the SMS facility (Refs. 9; 14; 48; 50; 60; 73). The analytical data sheets and chain-of-custody records are available in Reference 4, Appendices I, J, L, and M. The reporting limits on the analytical data sheets are equivalent to SQLs. Each SQL is sample-specific and corresponds to the lowest quantitative point on the calibration curve; it is adjusted for the amount of sample prepared and any dilutions performed, as well as for percent moisture (Ref. 13). The locations of the samples listed in Table 2 are provided in Reference 4, p. 36. The data validation reports are contained in Reference 4, pages 131 though 136, 185 through 189, 262 through 267, and 314 through 319.

TABLE 2: Analytical Results for Source No. 1 – December 2006

Sample ID	Sample Depth (feet bls)	Hazardous Substance	Concentration	Reporting Limit*	Reference
SB-1	0 to 5	Beryllium	0.741 mg/kg	0.349 mg/kg	4, pp. 320, 335
SB-1	0 to 5	Chromium	112 J+ mg/kg	0.582 mg/kg	4, pp. 320, 335
SB-1	0 to 5	Copper	1,900 mg/kg	0.466 mg/kg	4, pp. 320, 335
SB-1	0 to 5	Lead	28.3 mg/kg	1.16 mg/kg	4, pp. 320, 335
SB-1	0 to 5	Nickel	130 mg/kg	0.699 mg/kg	4, pp. 320, 335
SB-1	0 to 5	Silver	0.701 mg/kg	0.582 mg/kg	4, pp. 320, 335
SB-1	0 to 5	Zinc	387 mg/kg	2.66 mg/kg	4, pp. 320, 335
SB-4	0 to 5	Arsenic	11.8 mg/kg	1.67 mg/kg	4, pp. 302, 320
SB-4	0 to 5	Beryllium	1.83 mg/kg	0.334 mg/kg	4, pp. 302, 320

TABLE 2: Analytical Results for Source No. 1 – December 2006					
Sample ID	**Sample Depth (feet bls)**	**Hazardous Substance**	**Concentration**	**Reporting Limit***	**Reference**
SB-4	0 to 5	Cadmium	0.800 J mg/kg	0.446 mg/kg	4, pp. 302, 320
SB-4	0 to 5	Chromium	54.9 J+ mg/kg	0.557 mg/kg	4, pp. 302, 320
SB-4	0 to 5	Copper	1,170 mg/kg	0.446 mg/kg	4, pp. 302, 320
SB-4	0 to 5	Lead	41.4 mg/kg	1.11 mg/kg	4, pp. 302, 320
SB-4	0 to 5	Nickel	500 mg/kg	0.669 mg/kg	4, pp. 302, 320
SB-4	0 to 5	Zinc	397 mg/kg	2.56 mg/kg	4, pp. 302, 320
SB-5	0 to 5	Arsenic	4.42 mg/kg	1.71 mg/kg	4, pp. 321, 336
SB-5	0 to 5	Beryllium	5.20 mg/kg	0.342 mg/kg	4, pp. 321, 336
SB-5	0 to 5	Cadmium	1.08 J mg/kg	0.458 mg/kg	4, pp. 321, 336
SB-5	0 to 5	Chromium	174 J+ mg/kg	0.57 mg/kg	4, pp. 321, 336
SB-5	0 to 5	Copper	1,290 mg/kg	0.458 mg/kg	4, pp. 321, 336
SB-5	0 to 5	Lead	58.1 J+ mg/kg	1.14 mg/kg	4, pp. 321, 336
SB-5	0 to 5	Nickel	245 mg/kg	0.684 mg/kg	4, pp. 321, 336
SB-5	0 to 5	Zinc	560 mg/kg	2.62 mg/kg	4, pp. 321, 336
SB-6	0 to 5	Arsenic	3.08 mg/kg	1.87 mg/kg	4, pp. 321, 336
SB-6	0 to 5	Beryllium	4.93 mg/kg	0.374 mg/kg	4, pp. 321, 336
SB-6	0 to 5	Cadmium	1.73 J mg/kg	0.499 mg/kg	4, pp. 321, 336
SB-6	0 to 5	Chromium	184 J+ mg/kg	0.623 mg/kg	4, pp. 321, 336
SB-6	0 to 5	Copper	3,760 mg/kg	0.499 mg/kg	4, pp. 321, 336
SB-6	0 to 5	Lead	161 J+ mg/kg	1.25 mg/kg	4, pp. 321, 336
SB-6	0 to 5	Mercury	0.0713 J mg/kg	0.049 mg/kg	4, pp. 321, 336

TABLE 2: Analytical Results for Source No. 1 – December 2006					
Sample ID	**Sample Depth (feet bls)**	**Hazardous Substance**	**Concentration**	**Reporting Limit***	**Reference**
SB-6	0 to 5	Nickel	816 mg/kg	0.748 mg/kg	4, pp. 321, 336
SB-6	0 to 5	Silver	1.24 mg/kg	0.623 mg/kg	4, pp. 321, 336
SB-6	0 to 5	Zinc	1,950 mg/kg	2.87 mg/kg	4, pp. 321, 336
SB-7	0 to 5	Acetone	180 µg/kg	28.2 µg/kg	4, pp. 140, 170
SB-7	0 to 5	2-Butanone	47.4 µg/kg	7.04 µg/kg	4, pp. 140, 170
SB-7	0 to 5	Naphthalene	12,700 µg/kg	2,350 µg/kg	4, pp. 195, 235
SB-7	0 to 5	Acenaphthene	5,030 µg/kg	2,350 µg/kg	4, pp. 195, 235
SB-7	0 to 5	Fluorene	4,250 µg/kg	2,350 µg/kg	4, pp. 195, 235
SB-7	0 to 5	Phenanthrene	17,900 µg/kg	2,350 µg/kg	4, pp. 195, 235
SB-7	0 to 5	Anthracene	5,500 µg/kg	2,350 µg/kg	4, pp. 195, 235
SB-7	0 to 5	Pyrene	13,500 µg/kg	2,350 µg/kg	4, pp. 195, 235
SB-7	0 to 5	Benzo(a)anthracene	6,210 µg/kg	2,350 µg/kg	4, pp. 195, 235
SB-7	0 to 5	Chrysene	7,240 µg/kg	2,350 µg/kg	4, pp. 195, 235
SB-7	0 to 5	Benzo(k)fluoranthene	5,060 µg/kg	2,350 µg/kg	4, pp. 195, 235
SB-7	0 to 5	Benzo(a)pyrene	5,600 µg/kg	2,350 µg/kg	4, pp. 195, 235
SB-7	0 to 5	Indeno(1,2,3-cd)pyrene	3,350 µg/kg	2,350 µg/kg	4, pp. 195, 235
SB-7	0 to 5	Benzo(g,h,i)perylene	3,820 µg/kg	2,350 µg/kg	4, pp. 195, 235
SB-7	0 to 5	Aroclor-1232	1,680 J µg/kg	587 µg/kg	4, pp. 276, 304
SB-7	0 to 5	Aroclor-1260	4,580 J µg/kg	587 µg/kg	4, pp. 276, 304
SB-7	0 to 5	Arsenic	6.15 mg/kg	1.81 mg/kg	4, pp. 322, 336
SB-7	0 to 5	Beryllium	2.83 mg/kg	0.361 mg/kg	4, pp. 322, 336

TABLE 2: Analytical Results for Source No. 1 – December 2006

Sample ID	Sample Depth (feet bls)	Hazardous Substance	Concentration	Reporting Limit*	Reference
SB-7	0 to 5	Cadmium	5.05 J mg/kg	0.482 mg/kg	4, pp. 322, 336
SB-7	0 to 5	Chromium	317 J+ mg/kg	0.602 mg/kg	4, pp. 322, 336
SB-7	0 to 5	Copper	4,710 mg/kg	0.482 mg/kg	4, pp. 322, 336
SB-7	0 to 5	Lead	265 J+ mg/kg	1.20 mg/kg	4, pp. 322, 336
SB-7	0 to 5	Mercury	0.648 J mg/kg	0.0469 mg/kg	4, pp. 322, 336
SB-7	0 to 5	Nickel	381 mg/kg	0.722 mg/kg	4, pp. 322, 336
SB-7	0 to 5	Silver	2.72 mg/kg	0.602 mg/kg	4, pp. 322, 336
SB-7	0 to 5	Zinc	2,330 mg/kg	2.77 mg/kg	4, pp. 322, 336
SB-8	0 to 5	Aroclor-1232	78.7 µg/kg	57.1 µg/kg	4, pp. 276, 305
SB-8	0 to 5	Aroclor-1260	103 µg/kg	57.1 µg/kg	4, pp. 276, 305
SB-8	0 to 5	Arsenic	2.42 mg/kg	1.57 mg/kg	4, pp. 322, 337
SB-8	0 to 5	Beryllium	2.54 mg/kg	0.314 mg/kg	4, pp. 322, 337
SB-8	0 to 5	Cadmium	1.87 J mg/kg	0.419 mg/kg	4, pp. 322, 337
SB-8	0 to 5	Chromium	130 J+ mg/kg	0.524 mg/kg	4, pp. 322, 337
SB-8	0 to 5	Copper	1,810 mg/kg	0.419 mg/kg	4, pp. 322, 337
SB-8	0 to 5	Lead	56.6 J+ mg/kg	1.05 mg/kg	4, pp. 322, 337
SB-8	0 to 5	Mercury	0.192 J mg/kg	0.0433 mg/kg	4, pp. 322, 337
SB-8	0 to 5	Nickel	199 mg/kg	0.828 mg/kg	4, pp. 322, 337
SB-8	0 to 5	Silver	0.677 mg/kg	0.524 mg/kg	4, pp. 322, 337
SB-8	0 to 5	Zinc	694 mg/kg	2.41 mg/kg	4, pp. 322, 337
SB-9	0 to 5	Aroclor-1232	179 µg/kg	61.3 µg/kg	4, pp. 277, 305

TABLE 2: Analytical Results for Source No. 1 – December 2006

Sample ID	Sample Depth (feet bls)	Hazardous Substance	Concentration	Reporting Limit*	Reference
SB-9	0 to 5	Arsenic	3.64 mg/kg	1.44 mg/kg	4, pp. 322, 337
SB-9	0 to 5	Beryllium	5.62 mg/kg	0.288 mg/kg	4, pp. 322, 337
SB-9	0 to 5	Cadmium	2.82 J mg/kg	0.384 mg/kg	4, pp. 322, 337
SB-9	0 to 5	Chromium	215 J+ mg/kg	0.481 mg/kg	4, pp. 322, 337
SB-9	0 to 5	Copper	1,450 mg/kg	0.384 mg/kg	4, pp. 322, 337
SB-9	0 to 5	Lead	106 J+ mg/kg	0.961 mg/kg	4, pp. 322, 337
SB-9	0 to 5	Nickel	416 mg/kg	0.577 mg/kg	4, pp. 322, 337
SB-9	0 to 5	Silver	0.774 mg/kg	0.481 mg/kg	4, pp. 322, 337
SB-9	0 to 5	Zinc	1,080 mg/kg	2.21 mg/kg	4, pp. 322, 337
SB-10	0 to 5	Beryllium	3.25 mg/kg	0.356 mg/kg	4, pp. 322, 338
SB-10	0 to 5	Cadmium	0.959 J mg/kg	0.475 mg/kg	4, pp. 322, 338
SB-10	0 to 5	Chromium	113 J+ mg/kg	0.594 mg/kg	4, pp. 322, 338
SB-10	0 to 5	Copper	2,080 mg/kg	0.475 mg/kg	4, pp. 322, 338
SB-10	0 to 5	Lead	72.0 J+ mg/kg	1.19 mg/kg	4, pp. 322, 338
SB-10	0 to 5	Nickel	440 mg/kg	0.712 mg/kg	4, pp. 322, 338
SB-10	0 to 5	Zinc	899 mg/kg	2.73 mg/kg	4, pp. 322, 338
SB-16	0 to 5	Arsenic	2.51 mg/kg	1.90 mg/kg	4, pp. 323, 339
SB-16	0 to 5	Beryllium	1.54 mg/kg	0.379 mg/kg	4, pp. 323, 339
SB-16	0 to 5	Cadmium	5.77 mg/kg	0.508 mg/kg	4, pp. 323, 339
SB-16	0 to 5	Chromium	89.8 mg/kg	0.632 mg/kg	4, pp. 323, 339
SB-16	0 to 5	Copper	1,270 mg/kg	0.508 mg/kg	4, pp. 323, 339

TABLE 2: Analytical Results for Source No. 1 – December 2006					
Sample ID	**Sample Depth (feet bls)**	**Hazardous Substance**	**Concentration**	**Reporting Limit***	**Reference**
SB-16	0 to 5	Lead	75.4 J+ mg/kg	1.26 mg/kg	4, pp. 323, 339
SB-16	0 to 5	Mercury	0.126 mg/kg	0.050 mg/kg	4, pp. 323, 339
SB-16	0 to 5	Nickel	800 J mg/kg	0.759 mg/kg	4, pp. 323, 339
SB-16	0 to 5	Zinc	1,130 mg/kg	2.91 mg/kg	4, pp. 323, 339
SB-17	0 to 3	Acetone	186 µg/kg	27.4 µg/kg	4, pp. 144, 175
SB-17	0 to 3	2-Butanone	36.4 µg/kg	6.85 µg/kg	4, pp. 144, 175
SB-17	0 to 3	Naphthalene	24.2 µg/kg	6.85 µg/kg	4, pp. 144, 175
SB-17	0 to 3	Phenanthrene	576 µg/kg	439 µg/kg	4, pp. 175, 200
SB-17	0 to 3	Pyrene	688 µg/kg	439 µg/kg	4, pp. 175, 200
SB-17	0 to 3	Butyl benzyl phthalate	704 µg/kg	439 µg/kg	4, pp. 175, 200
SB-17	0 to 3	Chrysene	550 µg/kg	439 µg/kg	4, pp. 175, 200
SB-17	0 to 3	Benzo(a)pyrene	476 µg/kg	439 µg/kg	4, pp. 175, 200
SB-17	0 to 3	Arsenic	2.33 mg/kg	1.73 mg/kg	4, pp. 325, 341
SB-17	0 to 3	Beryllium	2.48 mg/kg	0.345 mg/kg	4, pp. 325, 341
SB-17	0 to 3	Chromium	163 mg/kg	0.576 mg/kg	4, pp. 325, 341
SB-17	0 to 3	Copper	1,510 mg/kg	0.460 mg/kg	4, pp. 325, 341
SB-17	0 to 3	Lead	73.6 J+ mg/kg	1.15 mg/kg	4, pp. 325, 341
SB-17	0 to 3	Nickel	543 J mg/kg	0.691 mg/kg	4, pp. 325, 341
SB-17	0 to 3	Silver	0.890 mg/kg	0.578 mg/kg	4, pp. 325, 341
SB-17	0 to 3	Zinc	562 mg/kg	2.65 mg/kg	4, pp. 325, 341
SB-18	0 to 5	Benzo(g,h,i)perylene	521 µg/kg	469 µg/kg	4, pp. 204, 240

TABLE 2: Analytical Results for Source No. 1 – December 2006					
Sample ID	**Sample Depth (feet bls)**	**Hazardous Substance**	**Concentration**	**Reporting Limit***	**Reference**
SB-18	0 to 5	Antimony	1.78 mg/kg	1.74 mg/kg	4, pp. 325, 341
SB-18	0 to 5	Arsenic	4.83 mg/kg	1.86 mg/kg	4, pp. 325, 341
SB-18	0 to 5	Beryllium	2.58 mg/kg	0.373 mg/kg	4, pp. 325, 341
SB-18	0 to 5	Cadmium	16.0 mg/kg	0.497 mg/kg	4, pp. 325, 341
SB-18	0 to 5	Chromium	185 mg/kg	0.621 mg/kg	4, pp. 325, 341
SB-18	0 to 5	Copper	2,880 mg/kg	0.497 mg/kg	4, pp. 325, 341
SB-18	0 to 5	Lead	119 J+ mg/kg	1.24 mg/kg	4, pp. 325, 341
SB-18	0 to 5	Mercury	0.0652 mg/kg	0.048 mg/kg	4, pp. 325, 341
SB-18	0 to 5	Nickel	374 J mg/kg	0.745 mg/kg	4, pp. 325, 341
SB-18	0 to 5	Zinc	1,190 mg/kg	2.88 mg/kg	4, pp. 325, 341
SB-20	0 to 5	Phenanthrene	1,050 µg/kg	483 µg/kg	4, pp. 200, 240
SB-20	0 to 5	Pyrene	1,130 µg/kg	483 µg/kg	4, pp. 200, 240
SB-20	0 to 5	Chrysene	679 µg/kg	483 µg/kg	4, pp. 200, 240
SB-20	0 to 5	Benzo(a)anthracene	585 µg/kg	483 µg/kg	4, pp. 200, 240
SB-20	0 to 5	Benzo(a)pyrene	551 µg/kg	483 µg/kg	4, pp. 200, 240
SB-20	0 to 5	Aroclor-1232	624 J µg/kg	302 µg/kg	4, pp. 282, 309
SB-20	0 to 5	Aroclor-1260	2,460 J µg/kg	302 µg/kg	4, pp. 282, 309
SB-20	0 to 5	Arsenic	3.76 mg/kg	1.91 mg/kg	4, pp. 325, 341
SB-20	0 to 5	Beryllium	0.918 mg/kg	0.381 mg/kg	4, pp. 325, 341
SB-20	0 to 5	Chromium	194 mg/kg	0.838 mg/kg	4, pp. 325, 341
SB-20	0 to 5	Copper	3,240 mg/kg	0.509 mg/kg	4, pp. 325, 341

TABLE 2: Analytical Results for Source No. 1 – December 2006

Sample ID	Sample Depth (feet bls)	Hazardous Substance	Concentration	Reporting Limit*	Reference
SB-20	0 to 5	Lead	61.0 J+ mg/kg	1.27 mg/kg	4, pp. 325, 341
SB-20	0 to 5	Nickel	906 J mg/kg	0.783 mg/kg	4, pp. 325, 341
SB-20	0 to 5	Zinc	663 mg/kg	2.92 mg/kg	4, pp. 325, 341
SB-21	0 to 5	Aroclor-1232	361 µg/kg	54.1 µg/kg	4, pp. 282, 310
SB-21	0 to 5	Aroclor-1260	381 µg/kg	54.1 µg/kg	4, pp. 282, 310
SB-21	0 to 5	Arsenic	3.88 mg/kg	1.74 mg/kg	4, pp. 325, 341
SB-21	0 to 5	Beryllium	3.18 mg/kg	0.348 mg/kg	4, pp. 325, 341
SB-21	0 to 5	Cadmium	0.552 mg/kg	0.484 mg/kg	4, pp. 325, 341
SB-21	0 to 5	Chromium	124 mg/kg	0.58 mg/kg	4, pp. 325, 341
SB-21	0 to 5	Copper	1,160 mg/kg	0.464 mg/kg	4, pp. 325, 341
SB-21	0 to 5	Lead	83.8 J+ mg/kg	1.16 mg/kg	4, pp. 325, 341
SB-21	0 to 5	Mercury	0.0956 mg/kg	0.045 mg/kg	4, pp. 325, 341
SB-21	0 to 5	Nickel	232 J mg/kg	0.698 mg/kg	4, pp. 325, 341
SB-21	0 to 5	Silver	0.714 mg/kg	0.58 mg/kg	4, pp. 325, 341
SB-21	0 to 5	Zinc	623 mg/kg	2.67 mg/kg	4, pp. 325, 341

Notes:

* The reporting limits on the analytical data sheets are sample-specific SQLs, each of which corresponds to the lowest quantitative point on the calibration curve and is adjusted for the amount of sample prepared, dilutions performed, and the percent moisture in the source samples (Ref. 13).

µg/kg Micrograms per kilogram
mg/kg Milligrams per kilogram
bls Below land surface
ID Identification
J The concentration is estimated, but the presence of the analyte is not in doubt.
J- The concentration is estimated with a low bias.
J+ The concentration is estimated with a high bias.
Aroclor Polychlorinated biphenyl (PCB) (Ref. 68)
SB Soil boring; sample material consists of waste (Ref. 4, pp. 36, 103 through 127).
SQL Sample quantitation limit

April 2009 START and REAC Integrated Assessment

The source samples listed in Table 3 were collected by START and REAC during the April 2009 integrated assessment (Refs. 55, p. 3, Appendix A, Figure 3, p. A-3; 55, Appendix B, Table 1C, p. B-4,; 59). The Source No. 1 samples were collected between 18 and 24 inches bls (Ref. 55, Appendix B, Table 1C, p. B-4; 55, Appendix D).

The samples were collected in accordance with the EPA Region 4 SESD Field Branches Quality System and Technical Procedures, Waste Sampling (Refs. 55, pp. 3, 4; 61). The samples were analyzed under the EPA Contract Laboratory Program (CLP) for total metals using statement of work (SOW) ILM05.4 (Refs. 55, Appendix E, pp. 289, 291; 81). EPA Region 4 SESD reviewed all data according to the contract SOW and EPA guidelines (Ref. 55, Appendix E, p. 265; 57). The minimum reporting limits (MRLs) are listed on the analytical data sheets in Ref. 55, Appendix E. Each MRL is sample-specific and corresponds to the lowest quantitative point on the calibration curve; it is adjusted for the amount of sample prepared and any dilutions performed, as well as for percent moisture (Ref. 58). MRLs are equivalent to SQLs (Refs. 1, p.51586; 58).

The traffic reports and chain-of-custody records are provided in Reference 59. Logbook notes are provided in Reference 55, Appendix D. The locations of the source samples are depicted in Reference 55, Appendix A, Figure 3, page A-3.

TABLE 3: Analytical Results for Source No. 1 – April 2009

Sample ID	Hazardous Substance	Concentration	MRL	References
SMS-01-WA	Beryllium	2.4 mg/kg	0.69 mg/kg	55, Appendix D, p. 7; 55, Appendix E, p. 289; 59, p. 1
SMS-01-WA	Chromium	88 mg/kg	1.4 mg/kg	55, Appendix D, p. 7; 55, Appendix E, p. 289; 59, p. 1
SMS-01-WA	Copper	2,100 mg/kg	3.4 mg/kg	55, Appendix D, p. 7; 55, Appendix E, p. 289; 59, p. 1
SMS-01-WA	Lead	36 J mg/kg	1.4 mg/kg	55, Appendix D, p. 7; 55, Appendix E, p. 289; 59, p. 1
SMS-01-WA	Nickel	1,200 mg/kg	5.5 mg/kg	55, Appendix D, p. 7; 55, Appendix E, p. 289; 59, p. 1
SMS-01-WA	Selenium	7.0 J mg/kg	4.8 mg/kg	55, Appendix D, p. 7; 55, Appendix E, p. 289; 59, p. 1
SMS-01-WA	Zinc	720 J mg/kg	8.3 mg/kg	55, Appendix D, p. 7; 55, Appendix E, p. 289; 59, p. 1
SMS-02-WA	Chromium	61 mg/kg	1.5 mg/kg	55, Appendix D, p. 7; 55, Appendix E, p. 291; 59, p. 1
SMS-02-WA	Copper	2,400 mg/kg	3.8 mg/kg	55, Appendix D, p. 7; 55, Appendix E, p. 291; 59, p. 1
SMS-02-WA	Lead	94 J mg/kg	1.5 mg/kg	55, Appendix D, p. 7; 55, Appendix E, p. 291; 59, p. 1
SMS-02-WA	Nickel	730 mg/kg	6.0 mg/kg	55, Appendix D, p. 7; 55, Appendix E, p. 291; 59, p. 1
SMS-02-WA	Silver	1.7 mg/kg	1.5 mg/kg	55, Appendix D, p. 7; 55, Appendix E, p. 291; 59, p. 1
SMS-02-WA	Zinc	2,200 J mg/kg	9.0 mg/kg	55, Appendix D, p. 7; 55, Appendix E, p. 291; 59, p. 1

Notes:

ID	Identification number
J	The concentration is estimated, but the presence of the analyte is not in doubt (Ref. 55, Appendix E, p. 268).
mg/kg	Milligrams per kilogram
MRL	Minimum reporting limit
SMS	Smokey Mountain Smelters
WA	Waste

2.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY

Source No. 1 samples contained metals, VOCs, SVOC, and PCBs (see Tables 2 and 3 of this HRS documentation record). Source No. 1 consists of the exterior waste pile where aluminum smelting wastes were disposed (Refs. 4, pp. 1, 33; 5, pp. 3, 5 through 8; 6, p. 4) (see Figure 2 of this documentation record).

Analytical results of surface water and sediment samples collected from the unnamed perennial tributary of the East Branch of Flenniken Branch, which receives runoff from Source No. 1, indicate that a release of hazardous substances has occurred to the surface water migration pathway as documented in Section 4.0 of this HRS documentation record. During the December 2006 site investigation a leachate seep containing arsenic, copper, lead, mercury, nickel, acetone, and 2-butanone was observed emanating from Source No. 1 and discharging into the unnamed perennial tributary of the East Branch of Flenniken Branch located along the eastern and southern borders of the property (Refs. 4, pp. 1, 2, 26, 36, 156, 178, 326, 345) (also see Figure 2 of this HRS documentation record). During the April 2009 integrated assessment, the leachate seep was also observed emanating from Source No. 1 and discharging into the unnamed perennial tributary of the East Branch of Flenniken Branch (Ref. 55, p. 4; 55, Appendix A, Figure 3, p. A-3; 55, Appendix B, Table 1D, p. B-5; 55, Appendix D, p. 18; 74) (also see Figure 2 of this HRS documentation record). Samples collected from the leachate seep in April 2009 contained arsenic, chromium, copper, lead, nickel, zinc, and 2-butanone (55, Appendix B, Table 1D, p. B-5, Table 5, pp. B-16 through B18). Also, during the 2009 integrated assessment, no maintained engineered cover, or functioning and maintained runon control system and runoff management system were present to contain runoff from Source No. 1 from entering the unnamed perennial tributary of the East Branch of Flenniken Branch (Refs. 74; 76, p. 2). Therefore, a containment factor value of 10 was assigned in Table 4 for the surface water migration pathway (Ref. 1, Section 4.1.2.1.2.1.1).

TABLE 4 – Containment Source No. 1

Containment Description	Containment Factor Value	References
Gas release to air:	NS	NA
Particulate release to air:	NS	NA
Release to ground water:	NS	NA
Release via overland migration and/or flood: As documented in Section 4.0, there is evidence of hazardous substance migration from the source area. Observations of Source No. 1 indicate no maintained engineered cover, or functioning and maintained run-on control and runoff management system. Runoff from Source No. 1 enters the pond and unnamed perennial tributary of the East Branch of Flenniken Branch located along the eastern and southern borders of the property.	10	1, Table 4-2; 4, pp. 2, 3, 10; 55, Appendix A, Figure 2, p. A-2; 74; 76, p. 2

Notes:

NA Not applicable
NS Not scored

2.4.2 HAZARDOUS WASTE QUANTITY

2.4.2.1.1 Hazardous Constituent Quantity

The information available is not sufficient to evaluate Tier A, hazardous constituent quantity, as required by Reference 1, Section 2.4.2.1.1.

Hazardous Constituent Quantity Assigned Value: NS

2.4.2.1.2 Hazardous Wastestream Quantity

The information available is not sufficient to evaluate Tier B, hazardous wastestream quantity, as required by Reference 1, Section 2.4.2.1.2.

Hazardous Wastestream Quantity Assigned Value: NS

2.4.2.1.3 Volume

The information available is not sufficient to evaluate Tier C, volume, as required by Reference 1, Section 2.4.2.1.3.

Volume Assigned Value: 0

2.4.2.1.4 Area

The area of the waste pile is about 3.3 acres (143,748 square feet). Aerial photographs from 2000 to 2008 were used to calculate the area of the waste pile along with visual observations, photographs of the denuded area, and logs of borings advanced in the waste pile (Refs. 4, pp. 1, 56, 103 through 127; 39; 46; 55, p. 4, Appendix D).

Sum (square feet) = 143,748
Equation for Assigning Value (Ref. 1, Table 2-5) = Area (A)/13

Area Assigned Value: 11,057.53
(Ref. 1, Section 2.4.2.1.4)

2.4.2.1.5 Calculation of Source Hazardous Waste Quantity Value

The source hazardous waste quantity (HWQ) value for Source No. 1 is 11,057.53 (Ref. 1, Section 2.4.2.1.5).

Source HWQ Value: 11,057.53

2.2 SOURCE CHARACTERIZATION

2.2.1 SOURCE IDENTIFICATION

Number of source: 2

Name of source: Waste Piles Located inside the Process Building (Interior Waste Piles)

Source Type: Pile

Description and Location of Source (with reference to a map of the site):

Source No. 2 consists of two waste piles located inside the dilapidated process building (Refs. 55, pp. 3, 4; 55, Appendix A, Figure 3, p. A-3; 66; 74; 76, pp. 1, 5, 7, 8; 78, p. 3). The process building has no floors, and holes have formed in the walls and ceiling (Ref. 55, p. 4; 55, Appendix C, pp. C-1, C-2). Source No. 2 contains gray material (primary aluminum smelting waste), similar in appearance to the waste contained in Source No. 1 (exterior waste pile) (Refs 4, p. 1; 46; 55, p. 4; 55, Appendix D, p. 4).

According to a 1985 Knox County Department of Air Pollution Control (KCDAPC) permit, SMS operated Rotary Aluminum Recovery Furnace #1 on the property (Refs. 5, p. 5; 49). Waste by-products from aluminum smelter operations include secondary aluminum, dross residues, and baghouse and furnace dusts (Ref. 38, pp. B-14, B-15). In 2006 and 2009, aluminum dross was observed inside the process building at the SMS facility (Refs. 4, p. 1; 55, Appendix C, pp. C-1, C-2; 76). During the 2006 REAC site investigation, the process building, which housed rotary and casting furnaces, contained piles of smelting waste. A sample collected from one of the waste piles inside the process building contained hazardous substances including antimony, arsenic, beryllium, cadmium, chromium, copper, lead, nickel, silver, and zinc (Ref. 4, pp. 3, 325).

During the 2009 integrated assessment conducted by START and REAC, three samples were collected from the Source No. 2 waste piles in the process building. The samples contained antimony, arsenic, cadmium, chromium, copper, cyanide, lead, mercury, nickel, and zinc (Ref. 55, Appendix B, Table 1C, p. B-4 and Table 4, p. B-13, B-14, B-15; 55, Appendix D, pp. 23, 24) (see Tables 6 and 7 of this HRS documentation record). Four samples were also collected from Source No. 2 for reactivity testing. The reactivity tests indicate that the waste from Source No. 2 is capable of generating ammonia and hydrogen cyanide (Ref. 78, pp. 3, 6, 7).

Table 5 lists samples collected from Source No. 2, descriptions and depths of the samples, and the hazardous substances detected during the 2006 REAC site investigation and April 2009 START and REAC integrated assessment (Ref. 55, Appendix B, Tables 1C and 4; 55, Appendix D, pp. 23, 24).

Table 5: Description of Samples Collected from Source No. 2

Sample ID	Sample Description	Sample Depth (inches below the surface of the pile)	Hazardous Substances	Reference
2006 REAC Site Investigation				
Inside Pile	Aluminum smelting waste	Unknown	antimony, arsenic, beryllium, cadmium, chromium, copper, lead, nickel, silver,	4, pp. 1, 3, 325; 71, pp. 26, 27, 28, 29
2009 START and REAC Integrated Assessment				
SMS-05-WA	Gray, sand-like, waste material	12 to 24	arsenic, chromium, copper, cyanide, lead, nickel, zinc	55, Appendix B, Table 1C, p. B-4 and Table 4, pp. B-13, B-14, B-15; 55, Appendix D, p. 23; 55, Appendix E pp. 297, 298
SMS-06-WA	Gray, sand-like, waste material	12 to 24	cadmium, chromium, copper, lead, nickel, zinc	55, Appendix B, Table 1C, p. B-4 and Table 4, pp. B-13, B-14, B-15; 55, Appendix D, p. 23; 55, Appendix E p. 299
SMS-07-WA	Gray, sand-like, waste material	12 to 24	cadmium, chromium, copper, lead, mercury, nickel , zinc	55, Appendix B, Table 1C, p. B-4 and Table 4, pp. B-13, B-14, B-15; 55, Appendix D, p. 24; 55, Appendix E, p. 301

Notes:

ID Identification
SMS Smokey Mountain Smelters
WA Waste

2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH SOURCE NO. 2

2006 REAC Site Investigation

The source sample listed in Table 6 was collected from Source No. 2 (interior waste piles) in December 2006 during the REAC site investigation. The sample was analyzed for TAL metals and mercury, (Ref. 4, p. 3). The metals analysis was conducted using REAC SOP 1811(EPA SW-846 Methods 3015/3050B/6010B) and REAC SOP 1832 (EPA SW-846 Methods 7000A/7470A/7471A) (Refs. 4, p. 316; 18; 47).

All samples were collected in accordance with the REAC Work Plan and Quality Assurance Project Plan prepared for Work Assignment No. 0-182 for the SMS facility (Refs. 9; 14; 48; 50; 60; 73). The analytical data sheets and chain-of-custody records are available in Reference 4, Appendix M. The reporting limits on the analytical data sheets are equivalent to SQLs. Each SQL is sample-specific and corresponds to the lowest quantitative point on the calibration curve; it is adjusted for the amount of sample prepared and any dilutions performed, as well as for percent moisture (Ref. 13). The location of the sample listed in Table 6 is depicted in Reference 4, p. 35. The data validation reports are contained in Reference 4, pp. 314 though 319.

TABLE 6: Analytical Results for Source No. 2 – December 2006

Sample ID	Hazardous Substance	Hazardous Substance Concentration	Reporting Limit*	Reference
Inside Pile	Antimony	3.34 mg/kg	1.54 mg/kg	4, pp. 325, 343
Inside Pile	Arsenic	2.13 mg/kg	1.85 mg/kg	4, pp. 325, 343
Inside Pile	Beryllium	2.25 mg/kg	0.330 mg/kg	4, pp. 325, 343
Inside Pile	Cadmium	0.900 mg/kg	0.440 mg/kg	4, pp. 325, 343
Inside Pile	Chromium	133 mg/kg	0.55 mg/kg	4, pp. 325, 343
Inside Pile	Copper	1,560 mg/kg	0.440 mg/kg	4, pp. 325, 343
Inside Pile	Lead	75.2 J+ mg/kg	1.10 mg/kg	4, pp. 325, 343
Inside Pile	Nickel	145 J mg/kg	0.660 mg/kg	4, pp. 325, 343
Inside Pile	Silver	0.806 mg/kg	0.55 mg/kg	4, pp. 325, 343
Inside Pile	Zinc	1,150 mg/kg	2.53 mg/kg	4, pp. 325, 343

Notes:

* The reporting limits on the analytical data sheets are sample-specific SQLs, each of which corresponds to the lowest quantitative point on the calibration curve and is adjusted for the amount of sample prepared, dilutions performed, and the percent moisture in the source samples (Ref. 13).

mg/kg Milligrams per kilogram
ID Identification
J The concentration is estimated, but the presence of the analyte is not in doubt.
J+ The concentration is estimated with a high bias.
SQL Sample quantitation limit

April 2009 START and REAC Integrated Assessment

The source samples listed in Table 7 were collected by START and REAC during the April 2009 integrated assessment (Ref. 55, p. 3; 55, Appendix B, Table 1C, p. B-4; 59, pp. 3, 4, 5). The Source No. 2 samples were collected between 12 and 24 inches below the surface of the piles (Ref. 55, Appendix B, Table 1C, p. B-4; 55, Appendix D, pp. 23, 24).

The Source No. 2 samples were collected in accordance with the EPA Region 4 SESD Field Branches Quality System and Technical Procedures, Waste Sampling (Refs. 55, p. 3; 61). The samples were analyzed under the EPA CLP for total metals and cyanide using the CLP SOW ILM05.4 (Refs. 55, Appendix E, pp. 269, 297, 299, 301; 81). EPA Region 4 SESD reviewed all data according to the contract SOW and EPA guidelines (Ref. 55, Appendix E, p. 265; 57). The MRLs are listed on the analytical data sheets in Ref. 55, Appendix E. Each MRL is sample-specific and corresponds to the lowest quantitative point on the calibration curve; it is adjusted for the amount of sample prepared and any dilutions performed, as well as for percent moisture (Ref. 58). The MRLs are equivalent to SQLs (Refs. 1, p. 51586; 58).

The traffic reports and chain-of-custody records are provided in Reference 59. Logbook notes are provided in Reference 55, Appendix D. The locations of the source samples are depicted in Reference 55, Appendix A, Figure 3, p. A-3.

TABLE 7: Analytical Results for Source No. 2 – April 2009

Sample ID	Hazardous Substance	Hazardous Substance Concentration	Minimum Reporting Limit	Reference
SMS-05-WA	Arsenic	6.2 J mg/kg	1.1 mg/kg	55, Appendix D, p. 23; 55, Appendix E, p. 297; 59, p. 3
SMS-05-WA	Chromium	71 mg/kg	1.1 mg/kg	55, Appendix D, p. 23; 55, Appendix E, p. 297; 59, p. 3
SMS-05-WA	Copper	1,000 mg/kg	2.7 mg/kg	55, Appendix D, p. 23; 55, Appendix E, p. 297; 59, p. 3
SMS-05-WA	Cyanide	3.4 mg/kg	2.7 mg/kg	55, Appendix D, p. 23; 55, Appendix E, p. 298; 59, p. 3
SMS-05-WA	Lead	49 J mg/kg	1.1 mg/kg	55, Appendix D, p. 23; 55, Appendix E, p. 297; 59, p. 3
SMS-05-WA	Nickel	320 mg/kg	4.3 mg/kg	55, Appendix D, p. 23; 55, Appendix E, p. 297; 59, p. 3
SMS-05-WA	Zinc	1,500 J mg/kg	6.5 mg/kg	55, Appendix D, p. 23; 55, Appendix E, p. 297; 59, p. 3

TABLE 7: Analytical Results for Source No. 2 – April 2009

Sample ID	Hazardous Substance	Hazardous Substance Concentration	Minimum Reporting Limit	Reference
SMS-06-WA	Cadmium	0.74 J mg/kg	0.62 mg/kg	55, Appendix D, p. 23; 55, Appendix E, p. 299; 59, p. 3
SMS-06-WA	Chromium	45 mg/kg	1.2 mg/kg	55, Appendix D, p. 23; 55, Appendix E, p. 299; 59, p. 3
SMS-06-WA	Copper	2,900 mg/kg	3.1 mg/kg	55, Appendix D, p. 23; 55, Appendix E, p. 299; 59, p. 3
SMS-06-WA	Lead	6.2 J mg/kg	1.2 mg/kg	55, Appendix D, p. 23; 55, Appendix E, p. 299; 59, p. 3
SMS-06-WA	Nickel	1,900 mg/kg	9.9 mg/kg	55, Appendix D, p. 23; 55, Appendix E, p. 299; 59, p. 3
SMS-06-WA	Zinc	300 mg/kg	7.4 mg/kg	55, Appendix D, p. 23; 55, Appendix E, p. 299; 59, p. 3
SMS-07-WA	Cadmium	4.0J mg/kg	0.58 mg/kg	55, Appendix D, p. 24; 55, Appendix E, p. 301; 59, p. 3
SMS-07-WA	Chromium	42 mg/kg	1.2 mg/kg	55, Appendix D, p. 24; 55, Appendix E, p. 301; 59, p. 3
SMS-07-WA	Copper	570 mg/kg	2.9 mg/kg	55, Appendix D, p. 24; 55, Appendix E, p. 301; 59, p. 3
SMS-07-WA	Lead	9.6 J mg/kg	1.2 mg/kg	55, Appendix D, p. 24; 55, Appendix E, p. 301; 59, p. 3
SMS-07-WA	Mercury	0.20 mg/kg	0.12 mg/kg	55, Appendix D, p. 24; 55, Appendix E, p. 301; 59, p. 3
SMS-07-WA	Nickel	370 mg/kg	4.6 mg/kg	55, Appendix D, p. 24; 55, Appendix E, p. 301; 59, p. 3
SMS-07-WA	Zinc	99,000 mg/kg	140 mg/kg	55, Appendix D, p. 24; 55, Appendix E, p. 301; 59, p. 3

Notes:

ID	Identification number
J	The concentration is estimated, but the presence of the analyte is not in doubt (Ref. 55, Appendix E, p. 268).
mg/kg	Milligrams per kilogram
MRL	Minimum reporting limit
SMS	Smokey Mountain Smelters
WA	Waste

2.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY

Source No. 2 samples contained antimony, arsenic, beryllium, cadmium, chromium, copper, cyanide, lead, mercury, nickel, silver, and zinc (Ref. 55, Appendix B, Table 4, pp. B-13, B-14, B-15) (see Tables 6 and 7 of this HRS documentation record). Source No. 2 consists of two waste piles located inside the process building. The interior waste piles contain gray material (aluminum smelting waste) similar in appearance to the waste contained in the exterior waste pile (Source No. 1) (Refs. 4, p. 1; 55, p. 4; 55, Appendix D, p. 4) (see Figure 2 of this documentation record).

Analytical results of surface water and sediment samples collected from the unnamed perennial tributary of the East Branch of Flenniken Branch, which receives runoff from Source No. 2, indicate that a release of hazardous substances has occurred to the surface water migration pathway, as documented in Section 4.0 of this HRS documentation record (Ref. 55, Appendix B, Table 1D, p. B-5 and Table 5, pp. B-16, B-17, B-18). The process building is dilapidated and structurally unstable (Refs. 4, p. 1; 76, pp. 1, 5, 8). Source No. 2 (interior waste piles) is located inside the dilapidated process building and is exposed to the elements in some areas (Refs. 66; 73; 74; 76, pp. 1, 5, 7, 8). No maintained engineered cover, or functioning and maintained runon control system and runoff management system were present in 2006 or 2009 to contain runoff from Source No. 2 from entering the unnamed perennial tributary of the East Branch of Flenniken Branch (Refs. 74; 76, p. 2). Therefore, as presented in Table 8, a containment factor value of 10 was assigned for the surface water migration pathway (Ref. 1, Section 4.1.2.1.2.1.1).

TABLE 8: Containment Source No. 2

Containment Description	Containment Factor Value	References
Gas release to air:	NS	NA
Particulate release to air:	NS	NA
Release to ground water:	NS	NA
Release via overland migration and/or flood: Observations of Source No. 2 indicate no maintained engineered cover, or functioning and maintained runon control system and runoff management system. Runoff from Source No. 2 enters the pond and unnamed perennial tributary of the East Branch of Flenniken Branch located in the eastern portion of the property.	10	1, Table 4-2; 55, pp. 3, 4; 55, Appendix C, pp. C-1, C-2; 55, Appendix D; 73; 74; 76, p. 2

Notes:

NA Not applicable
NS Not scored

2.4.2.1 HAZARDOUS WASTE QUANTITY

2.4.2.1.1 Hazardous Constituent Quantity

The information available is not sufficient to evaluate Tier A, hazardous constituent quantity, as required by Ref. 1, Section 2.4.2.1.1.

Hazardous Constituent Quantity Assigned Value: NS

2.4.2.1.2 Hazardous Wastestream Quantity

The information available is not sufficient to evaluate Tier B, hazardous wastestream quantity, as required by Ref. 1, Section 2.4.2.1.2.

Hazardous Wastestream Quantity Assigned Value: NS

2.4.2.1.3 Volume

The volume of Source No. 2, interior waste piles, is about 44,657.325 ft^3 (Ref. 65; 71). Two piles are located inside the process building. The first pile is located on the upper level of the building and the second pile is located on the lower level of the process building (Refs. 65; 78, p. 3). The volume of the two waste piles was determined by dividing each of the two piles into three sections and then adding the volumes. The volume of the pile located on the upper level of the process building is 6,020.325 ft^3. The volume of the pile located on the lower level of the process building is 38,637 ft^3 (Ref. 65; 71).

Sum (yd^3): 1,653.97 yd^3 (44,657.325 ft^3)
Equation for Assigning Value (Ref. 1, Table 2-5): Volume (V)/2.5

Volume Assigned Value: 661.58
(Ref. 1, Section 2.4.2.1.3)

2.4.2.1.4 Area

The volume of Source No. 2 is provided in Section 2.4.2.1.3. Therefore, area is not evaluated (Ref. 1, Section 2.4.2.1.3).

Area Assigned Value: Not evaluated

2.4.2.1.5 Calculation of Source Hazardous Waste Quantity Value

The HWQ value for Source No. 2 is 661.58 (Ref. 1, Table 2-5).

Source HWQ Value: 661.58

SUMMARY OF SOURCE DESCRIPTIONS

TABLE 9: Summary of Source Descriptions

Source No.	Source Hazardous Waste Quantity Value	Source Hazardous Constituent Quantity Complete? (Yes/No)	Containment Factor Value by Pathway				
			Ground Water (GW) (Ref. 1, Table 3-2)	Surface Water (SW)		Air	
				Overland/ Flood (Ref. 1, Table 4-2)	GW to SW (Ref. 1, Table 3-2)	Gas (Ref. 1, Table 6-3)	Particulate (Ref. 1, Table 6-9)
1	11,057.53	No	NS	10	NS	NS	NS
2	661.58	No	NS	10	NS	NS	NS

Total Source Hazardous Waste Quantity Value = 11,719.11

Notes:

NS Not Scored

Description of Other Possible Sources:

Other sources of concern are present at the SMS facility. However, insufficient information is available to evaluate the other possible sources. The sources include, but are not limited to, the following:

- A depression located south of the process building (Ref. 6, pp. 4, 21). This depression may have been used as a settling pond prior to operations by the SMS facility (Ref. 6, p. 4). Aluminum, cadmium, and mercury, among others, have been detected in this area (Ref. 6, pp. 15, 21). The depression was not observed during the March 2006 site reconnaissance (Ref. 76, p. 2).
- Collection hoppers located underneath the baghouses (Ref. 6, pp. 2, 4). Benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and bis(2-ethylhexyl)phthalate, among others, have been detected in baghouse dust samples (Ref. 6, pp. 4, 15, 21, 127).
- Casting furnace located inside the process building. A sample collected from the casting furnace trough contained aluminum, cadmium, chromium, benzo(a)pyrene, pyrene, and chrysene, among others (Ref. 6, pp. 4, 15, 21, 34).
- Mixed waste underlying the Source No. 1 aluminum smelter waste pile. Borings advanced during the 2009 integrated assessment conducted by START and REAC indicate the presence of aluminum smelting waste mixed with paper and wood fragments, broken white and red brick fragments, angular limestone gravel, clay, and silty clay. The presence of gravel and clay suggests possible contemporaneous backfill or cover of waste consistent with HRS source type “landfill”. The depth at the top of the mixed waste ranges from three to 17 feet bls (Refs. 4, pp. 103 through 127; 73; 77).

4.0 SURFACE WATER MIGRATION PATHWAY

4.1 OVERLAND/FLOOD MIGRATION COMPONENT

4.1.1.1 Definition of Hazardous Substance Migration Path for Overland/Flood Component

The hazardous substance migration pathway includes both the overland segment and the in-water segment that hazardous substances would take as they migrate away from sources. The overland segment begins at the source and proceeds downgradient to the probable point of entry (PPE) to surface water. The in-water segment at the PPE continues in the direction of flow (Ref. 1, Section 4.1.1.1).

Overland flow from Source Nos. 1 and 2 enters an unnamed perennial tributary of the East Branch of Flenniken Branch. The unnamed perennial tributary of the East Branch of Flenniken Branch originates on the SMS property, east of the process building and flows along the eastern and southern portions of the SMS property (Refs. 3; 52; 73; 74). The unnamed perennial tributary is also called Smokey Mountain Branch (Ref. 4, p. 33). The sources, in an upgradient to downgradient location, on the SMS property include: Source No. 2, interior waste piles and Source No. 1, exterior waste pile (Ref. 3; 76) (see Figure 2 of this HRS documentation record).

Overland flow from Source No. 2 follows the land topography for about 159 feet in a southeasterly direction and enters the unnamed perennial tributary located on the eastern portion of the SMS property. The point at which overland flow from Source No. 2 enters the unnamed perennial tributary is PPE 1 (Refs. 3; 74; 76) (see Figures 2 and 3 of this HRS documentation record). PPE 1 is located upstream of the pond located on the eastern portion of the SMS property (Refs. 3; 4, p. 33; 55, Appendix A, Figure 2, p. A-2; 76) (see Figure 3 of this HRS documentation record).

Overland flow from Source No. 1 follows the land topography for about 51 feet in a south-southeasterly direction into the pond and unnamed perennial tributary both upstream and downstream of the pond (Refs. 3; 74; 76) (see Figure 3 of this HRS documentation record). PPE 2 is located in the unnamed perennial tributary downstream of the pond (Refs. 3; 74; 76) (see Figure 3 of this HRS documentation record). A leachate seep is located at the southwestern corner of Source No. 1. Effluent from the leachate seep flows overland for about 53 feet and enters the unnamed perennial tributary south of Source No. 1. The point at which runoff from the leachate seep from Source No. 1 enters the unnamed perennial tributary is PPE 3 (Refs. 3; 55, Appendix A, Figure 2, p. A-2) (also see Figure 3 of this HRS documentation record).

PPE 3 is the farthest downstream PPE of the in-water segment of the 15-mile surface water migration pathway target distance limit (TDL) (Refs. 3; 74; 76). From PPE 3, the unnamed perennial tributary flows south-southwest for about 431 feet and enters the East Branch of Flenniken Branch. The East Branch of Flenniken Branch flows south-southwest for about 1.20 miles and joins Flenniken Branch (see Figures 1, 2, and 3 of this HRS documentation record). Flenniken Branch continues south for about 1.0 mile before entering the Fort Loudoun Reservoir (Ref. 3). The Fort Loudoun Reservoir is an impoundment of the Tennessee River (Ref. 24, p. 1). Flow continues in the Tennessee River for about 12.67 miles completing the 15-mile surface water migration pathway TDL (Ref. 3).

The unnamed tributary of the East Branch of Flenniken Branch, the East Branch of Flenniken Branch, and Flenniken Branch are perennial surface water bodies (Refs. 3; 55, p. 4, Appendix B, Table 1D; 55, Appendix D, p. 5; 73; 74).

4.1.2.1 LIKELIHOOD OF RELEASE

4.1.2.1.1 OBSERVED RELEASE – Chemical Analysis

December 2006 REAC Site Investigation

Background Samples

During the 2006 site investigation conducted by REAC, a background surface water sample (SW-Background /BKGND 182-0060) was collected from the East Branch of Flenniken Branch about 0.47 mile upgradient of the unnamed perennial tributary's confluence with the East Branch of Flenniken Branch (Refs. 3; 4, pp. 2, 3, 31, 177) (see Figure 3 of this HRS documentation record). The background sample is used to document background concentrations for the surface water samples collected from the unnamed perennial tributary of the East Branch of Flenniken Branch downstream from Source Nos. 1 and 2 (Ref. 4, pp. 2, 31, 35). Because the unnamed perennial tributary of the East Branch of Flenniken Branch originates on the SMS property, a background sample could not be collected from the tributary. No potential sources of contamination have been documented along the East Branch of Flenniken Branch upgradient of the SMS property (Ref. 55, Appendix D, pp. 22, 23).

The background surface water sample was collected in accordance with the REAC Work Plan and Quality Assurance Project Plan prepared for Work Assignment No. 0-182 for the SMS facility (Refs. 14; 21; 48; 50; 73). The location of the background surface water sample listed in Table 10 is depicted in Reference 4, page 31. The chain-of-custody record is available in Reference 4, Appendix I, p. 177 and Appendix M, p. 344.

The background surface water sample and the downstream surface water samples were collected from similar surface water bodies during the same sampling event and in accordance with the same sampling procedures (Refs. 3; 4, pp. 2, 31, 177; 14; 21; 48). The background surface water sample was collected at the surface of the water by partially submerging the sampling container into the surface water body (Refs. 21; 73; 74; 79).

TABLE 10: Background Surface Water Sample – December 2006

Sample ID	Sample Location	Depth	Date Sampled	Reference
SW-Background/ BKGND 182-0060	East Branch of Flenniken Branch, about 0.47 mile upgradient of its confluence with the unnamed perennial tributary on the SMS property	At the surface of the water	12/14/2006	3; 4, pp. 2, 3, 31, 177; 21; 73; 79

Notes:

BKGND	Background
SW	Surface water
ID	Identification

Background Concentrations

The background surface water sample listed in Table 11 was collected by REAC during the December 2006 site investigation (Ref. 4, pp. 2, 3, 4, 31, 35, 177). The background surface water sample was analyzed under the EPA REAC for TAL metals and VOCs (Refs. 4, pp. 133, 177, 316, 344; 14, p. 2). The metals analysis was conducted using REAC SOP 1811 (EPA SW-846 Methods 3015/3050B/6010B) and REAC SOP 1832 (EPA SW-846 Methods 7000A/7470A/7471A) (Refs. 4, p. 316; 18; 47). VOCs were analyzed using REAC SOP 1806, EPA SW-846 Methods 8000B and 8260B (Refs. 4, p. 187; 20). The analytical data sheets are contained in Reference 4, Appendices I and M. The reporting limits on the analytical data sheets are SQLs. Each SQL is sample-specific and corresponds to the lowest quantitative point on the calibration curve, and is adjusted for the amount of sample prepared and any dilutions performed (Ref. 13). The data validation reports are contained in Reference 4, pages 130 through 136 and 314 through 319.

TABLE 11: Analytical Results for Background Surface Water Sample – December 2006

Sample ID	Hazardous Substance	Concentration	Reporting Limit *	Reference
SW-Background/ BKGND 182-0060	Acetone	20.0U µg/L	20.0 µg/L	4, pp. 155, 177
SW-Background/ BKGND 182-0060	2-Butanone	5.00U µg/L	5.00 µg/L	4, pp. 155, 177
SW-Background/ BKGND 182-0060	Antimony	14.0U µg/L	14.0 µg/L	4, pp. 326, 344
SW-Background/ BKGND 182-0060	Arsenic	17.0U µg/L	17.0 µg/L	4, pp. 326, 344
SW-Background/ BKGND 182-0060	Copper	4.00U µg/L	4.00 µg/L	4, pp. 326, 344
SW-Background/ BKGND 182-0060	Mercury	0.200U µg/L	0.200 µg/L	4, pp. 326, 344
SW-Background/ BKGND 182-0060	Nickel	5.0U µg/L	5.0 µg/L	4, pp. 326, 344

Notes:

* The reporting limits on the analytical data sheets are sample-specific SQLs, each of which corresponds to the lowest quantitative point on the calibration curve and is adjusted for the amount of sample prepared and any dilutions performed (Ref. 13).

BKGND Background
µg/L Micrograms per liter
ID Identification
SW Surface water
U The analyte was not detected at or above the reporting limit.

Contaminated Sample

The surface water sample listed in Table 12 was collected during the December 2006 site investigation conducted by REAC (Ref. 4, p. 2, 3, 31, 35, 177). The surface water sample was collected in accordance with the REAC Work Plan and Quality Assurance Project Plan prepared for Work Assignment No. 0-182 for the SMS facility (Refs. 14; 21; 48; 50; 73). The surface water sample was collected from the surface of the water by partially submerging the sampling container in the surface water body (Refs. 21; 73; 79). The location of the downstream surface water sample listed in Table 12 is depicted in Reference 4, page 35. The chain-of-custody record is available in Reference 4, Appendix I, p. 177 and Appendix M, p. 344.

TABLE 12: Surface Water Sample – December 2006

Sample ID	Sample Location	Distance from PPE	Depth	Date Sampled	Reference
SW-Stream/ Strm 182-0061	Unnamed perennial tributary of East Branch of Flenniken Branch	799 feet from PPE 1, 551 feet from PPE 2, 73 feet from PPE 3	At the surface of the water	12/14/2006	4, pp. 2, 35, 177; 21; 73

Notes:

ID Identification
PPE Probable point of entry
Strm Stream
SW Surface water

Concentrations in Contaminated Sample

The surface water sample listed in Table13 was collected by REAC during the December 2006 site investigation (Ref. 4, pp. 2, 3, 31, 35, 177). The surface water sample was analyzed under the EPA REAC for TAL metals and VOCs (Refs. 4, pp. 133,177, 316, 344; 14, p. 2). The metals analysis was conducted using REAC SOP 1811 (EPA SW-846 Methods 3015/3050B/6010B) and REAC SOP 1832 (EPA SW-846 Methods 7000A/7470A/7471A) (Refs. 4, p. 316; 18; 47). VOCs were analyzed using REAC SOP 1806, EPA SW-846 Methods 8000B and 8260B (Refs. 4, p. 133; 20). The analytical data sheets are contained in Reference 4, Appendices I and M. The reporting limits on the analytical data sheets are SQLs. Each SQL is sample-specific and corresponds to the lowest quantitative point on the calibration curve, and is adjusted for the amount of sample prepared and any dilutions performed (Ref. 13). The data validation reports are available in Reference 4, pages 130 through 136 and 314 through 319.

TABLE 13: Analytical Results for Surface Water Sample – December 2006

Sample ID	Hazardous Substance	Concentration	Reporting Limit *	Reference
SW-Stream/182-0061 Strm	Acetone	45.7 µg/L	20.0 µg/L	4, p. 155, 177
SW-Stream/182-0061 Strm	2-Butanone	8.21 µg/L	5.00 µg/L	4, p. 155, 177
SW-Stream/182-0061 Strm	Antimony	18.9 µg/L	14.0 µg/L	4, p. 326, 344
SW-Stream/182-0061 Strm	Arsenic	17.3 µg/L	17.0 µg/L	4, p. 326, 344
SW-Stream/182-0061 Strm	Copper	988 µg/L	4.00 µg/L	4, p. 326, 344
SW-Stream/182-0061 Strm	Mercury	0.421 µg/L	0.200 µg/L	4, p. 326, 344
SW-Stream/182-0061 Strm	Nickel	29.7 µg/L	5.0 µg/L	4, p. 326, 344

Notes:

* The reporting limits on the analytical data sheets are sample-specific SQLs, each of which corresponds to the lowest quantitative point on the calibration curve and is adjusted for the amount of sample prepared and any dilutions performed (Ref. 13).

ID Identification
µg/L Micrograms per liter
Strm Stream
SW Surface water

2009 START and REAC Integrated Assessment

Background surface water and sediment samples listed in Table 14 were collected by START and REAC during the April 2009 integrated assessment (Ref. 55, p. 1; 55, Appendix B, Table 1D, p. B-5 and Table 1E, p. B-6; 55, Appendix D, pp. 21, 22, 23; 59, pp. 5, 6, 7, 11). The background surface water (SMS-01-SW) and sediment (SMS-01-SD) samples were collected from the East Branch of Flenniken Branch about 0.5 mile upgradient of sources on the SMS property. The background samples are used to document background conditions for the samples collected from the unnamed perennial tributary of the East Branch of Flenniken Branch, downgradient of sources at the SMS property (Ref. 55, Appendix A, Figure 4, p. A-4; 55, Appendix B, Table 1D, p. B-5 and Table 1E, p. B-6; 55, Appendix D, pp. 15, 16, 17, 21, 22, 23). Because the unnamed perennial tributary of the East Branch of Flenniken Branch originates on the SMS property, a background sample could not be collected from the tributary. No potential sources of contamination have been documented along the East Branch of Flenniken Branch upstream of the SMS property (Ref. 55, Appendix D, pp. 22, 23).

The background surface water sample was collected at the surface of the water, and the sediment sample was collected from 0 to 3 inches below the stream bed (Ref. 55, Appendix B, Table 1D, p. B-5 and Table 1E, p. B-6; 55, Appendix D, pp. 21, 22; 74; 79). The samples were collected in accordance with the EPA Region 4 SESD Field Branches Quality System and Technical Procedures, Surface Water and Sediment Sampling (Refs. 55, pp. 3, 4; 56, p. 11; 62; 63). The chain-of-custody records are provided in Reference 59. Logbook notes are available in Reference 55, Appendix D. The location of the background samples is depicted in Reference 55, Appendix A, Figure 4, page A-4.

The background surface water and sediment samples and downstream surface water and sediment samples were collected from similar surface water bodies during the same sampling event and in accordance with the same sampling procedures (Refs. 43; 55, Appendix D, pp. 15, 16, 17, 21, 22; 59, pp. 3, 5, 6, 7, 11; 62; 63; 73; 74; 79).

TABLE 14: Surface Water and Sediment Samples – April 2009

Sample ID	Description of Location	Depth	Date Sampled	References
SMS-01-SW	East Branch of Flenniken Branch, about 0.5 mile upgradient of sources on the SMS property	At the surface of the water	4/28/2009	3; 55, Appendix A, Figure 4, p. A-4; 55, Appendix B, Table 1D, p. B-5; 55, Appendix D, p. 21; 59, pp. 5, 11; 74; 79
SMS-01-SD	East Branch of Flenniken Branch, about 0.5 mile upgradient of sources on the SMS property	0 to 3 inches below the stream bed	4/28/2009	3; 55, Appendix A, Figure 4, p. A-4; 55, Appendix B, Table 1E, p. B-6; 55, Appendix D, p. 22; 59, pp. 5, 6, 7

Notes:

ID Identification number
SD Sediment
SMS Smokey Mountain Smelters
SW Surface water

Background Concentrations

The background surface water and sediment samples listed in Table 15 were collected during the April 2009 integrated assessment (Ref. 55, p. 1; 55, Appendix B, Table 1D, p. B-5 and Table 1E, p. B-6; 55, Appendix D, pp. 21, 22, 23; 59, pp. 6, 11). The total metals and cyanide analyses for the background surface water sample was conducted by the EPA Region 4 Analytical Support Branch (ASB) using EPA Methods 200.8 and 6010 (total metals), 245.1 (mercury), and 335.4 (cyanide). The total metals data were verified in accordance with the EPA Region 4 SESD ASB Laboratory Operations and Quality Assurance Manual (LOQAM) (Refs. 55, Appendix E, pp. 307, 318; 57; 72). The total metals and cyanide analyses for the background sediment sample was conducted under the EPA CLP SOW ILM05.4 (Ref. 55, Appendix E, p. 281; 81). EPA Region 4 SESD reviewed all data in accordance with the CLP SOW ILM05.4 and EPA guidelines (Ref. 55, Appendix E, p. 265; 57). The MRLs are listed on the analytical data sheets in Reference 55, Appendix E. Each MRL is sample-specific and corresponds to the lowest quantitative point on the calibration curve; it is adjusted for the amount of sample prepared and any dilutions performed, as well as for percent moisture (Ref. 58). The MRLS are equivalent to SQLs (Refs. 1, p. 51586; 58).

TABLE 15: Analytical Results for Surface Water and Sediment Samples – April 2009

Sample ID	Hazardous Substance	Concentration	MRL	References
SMS-01-SW	Antimony	1.0U µg/L	1.0 µg/L	55, Appendix E, p. 307; 59, p. 11
SMS-01-SW	Arsenic	1.0U µg/L	1.0 µg/L	55, Appendix E, p. 307; 59, p. 11
SMS-01-SW	Chromium	5.0U µg/L	5.0 µg/L	55, Appendix E, p. 307; 59, p. 11
SMS-01-SW	Copper	10U µg/L	10 µg/L	55, Appendix E, p. 307; 59, p. 11
SMS-01-SW	Cyanide	15U µg/L	15 µg/L	55, Appendix E, p. 318; 59, p. 11
SMS-01-SW	Lead	1.0U µg/L	1.0 µg/L	55, Appendix E, p. 307; 59, p. 11
SMS-01-SW	Mercury	0.10U µg/L	0.10 µg/L	55, Appendix E, p. 307; 59, p. 11
SMS-01-SW	Zinc	10U µg/L	10 µg/L	55, Appendix E, p. 307; 59, p. 11
SMS-01-SD	Chromium	14 mg/kg	1.5 mg/kg	55, Appendix E, p. 281; 59, p. 6
SMS-01-SD	Copper	8.5 mg/kg	3.8 mg/kg	55, Appendix E, p. 281; 59, p. 6
SMS-01-SD	Nickel	3.6 J* (4.86) mg/kg	6.1 mg/kg	55, Appendix E, p. 281; 59, p. 6

TABLE 15: Analytical Results for Surface Water and Sediment Samples – April 2009				
Sample ID	**Hazardous Substance**	**Concentration**	**MRL**	**References**
SMS-01-SD	Zinc	41 J** (61.5) mg/kg	9.2 mg/kg	55, Appendix E, p. 281; 59, p. 6

Notes:

( )	Concentrations were adjusted in accordance with Reference 82.
*	Estimated result with a low bias
**	Estimated result with an unknown bias
µg/L	Micrograms per liter
J	The concentration is estimated, but the presence of the analyte is not in doubt.
mg/kg	Milligrams per kilogram
ID	Identification
MRL	Minimum reporting limit
SD	Sediment
SMS	Smokey Mountain Smelters
SW	Surface water
U	The analyte was not detected at or above the minimum reporting limit.

Contaminated Samples

Surface water and sediment samples listed in Table 16 were collected along the unnamed perennial tributary of the East Branch of Flenniken Branch during the April 2009 integrated assessment conducted by START and REAC (Ref. 55, pp. 1, 3, Appendix A, Figure 3, p. A-3; 55, Appendix B, Table 1D, p. B-5 and Table 1E, p. B-6; 55, Appendix D, pp. 15, 16, 17; 59, pp. 3, 4). The samples were collected downstream of Source Nos. 1 and 2 (Ref. 55, Figure 3, p. A-3). The surface water samples were collected at the surface of the water and the sediment samples were collected from 0 to 3 inches below the stream bed (Refs. 55, Appendix B, Table 1D, p. B-5 and Table 1E, p. B-6; 55, Appendix D, pp. 15, 16, 17; 74, 79). The surface water and sediment samples were collected in accordance with the EPA Region 4 SESD Field Branch Quality System and Technical Procedures, Surface Water and Sediment Sampling (Refs. 55, pp. 3, 4; 56, p. 11; 62; 63). The traffic reports and chain-of-custody records are provided in Reference 59. Logbook notes are provided in Reference 55, Appendix D. Locations of the surface water and sediment samples and PPEs are depicted in Reference 55, Appendix A, Figure 3, page A-3 (also see Figure 3 of this HRS documentation record).

TABLE 16: Surface Water and Sediment Samples – April 2009

Sample ID	Sample Location	Distance from PPE	Depth	Date Sampled	References
SMS-02-SW	Where the southwestern Source No. 1 leachate seep enters the unnamed perennial tributary of the East Branch of Flenniken Branch	725 feet from PPE 1, 475 feet from PPE 2, 0 feet from PPE 3	At the surface of the water	04/28/ 2009	3; 55, Appendix A, Figure 3, p. A-3; 55, Appendix B, Table 1D, p. B-5; 55, Appendix D, p. 16; 59, pp. 4, 11; 74; 79
SMS-02-SD	Where the southwestern Source No. 1 leachate seep enters the unnamed perennial tributary of the East Branch of Flenniken Branch	725 feet from PPE1, 475 feet from PPE 2, 0 feet from PPE 3	0 to 3 inches below the stream bed	04/28/ 2009	3; 55, Appendix A, Figure 3, p. A-3; 55, Appendix B, Table 1E, p. B-6; 55, Appendix D, p. 17; 59, pp. 3, 4
SMS-03-SW	Unnamed perennial tributary of the East Branch of Flenniken Branch	760 feet from PPE1, 510 feet downstream from PPE 2, 30 feet from PPE 3	At the surface of the water	04/28/ 2009	3; 55, Appendix A, Figure 3, p. A-3; 55, Appendix B, Table 1D, p. B-5; 55, Appendix D, p. 15; 59, pp. 4, 11; 74; 79
SMS-03-SD	Unnamed perennial tributary of the East Branch of Flenniken Branch	760 feet from PPE1, 510 feet downstream from PPE 2, 30 feet from PPE 3	0 to 3 inches below the stream bed	04/28/ 2009	3; 55, Appendix A, Figure 3, p. A-3; 55, Appendix B, Table 1E, p. B-6; 55, Appendix D, p. 16; 59, pp. 3, 4

Notes:

ID	Identification
PPE	Probable point of entry
SD	Sediment
SMS	Smokey Mountain Smelters
SW	Surface water

Contaminated Concentrations

Samples listed in Table 17 were collected from the unnamed perennial tributary of the East Branch of Flenniken Branch during the April 2009 integrated assessment (Refs. 55, pp. 1, 3; 55, Appendix A, Figure 3, p. A-3; 55, Appendix B, Table 1D, p. B-5 and Table 1E, p. B-6; 55, Appendix D, pp. 15, 16, 17; 59, pp. 3, 11). The total metals and cyanide analyses for the contaminated surface water samples were conducted by the EPA Region 4 ASB using EPA Methods 200.8 and 6010 (total metals), 245.1 (mercury), and 335.4 (cyanide). The total metals and cyanide data were verified in accordance with the EPA Region 4 SESD ASB LOQAM (Refs. 55, Appendix E, pp. 283, 308, 310, 314, 319, 321; 57; 72). The total metals analysis for the contaminated sediment samples were conducted under the EPA CLP using SOW ILM05.4 (Ref. 55, Appendix E, pp. 283, 287; 81). EPA Region 4 SESD reviewed all data in accordance with the CLP ILM05.4 SOW and EPA guidelines (Ref. 55, Appendix E, p. 265; 57). The MRLs are listed on the analytical data sheets in Reference 55, Appendix E. Each MRL is sample-specific and corresponds to the lowest quantitative point on the calibration curve; it is adjusted for the amount of sample prepared and any dilutions performed, as well as for percent moisture (Ref. 58). The MRLs are equivalent to SQLs (Refs. 1, p.51586; 58).

TABLE 17: Analytical Results for Surface Water and Sediment Samples – April 2009

Sample ID	Hazardous Substance	Concentration	MRL	References
SMS-02-SW	Antimony	19 µg/L	10 µg/L	55, Appendix E, p. 308; 59, p. 11
SMS-02-SW	Arsenic	17 µg/L	10 µg/L	55, Appendix E, p. 308; 59, p. 11
SMS-02-SW	Copper	370 µg/L	60 µg/L	55, Appendix E, p. 308; 59, p. 11
SMS-02-SW	Cyanide	15 µg/L	15 µg/L	55, Appendix E, p. 319; 59, p. 11
SMS-02-SW	Lead	12 µg/L	5.0 µg/L	55, Appendix E, p. 308; 59, p. 11
SMS-02-SW	Mercury	0.25 µg/L	0.10 µg/L	55, Appendix E, p. 308; 59, p. 11
SMS-02-SW	Zinc	87 µg/L	60 µg/L	55, Appendix E, p. 308; 59, p. 11
SMS-02-SD	Chromium	160 mg/kg	1.8 mg/kg	55, Appendix E, p. 283; 59, p. 3
SMS-02-SD	Copper	960 mg/kg	4.6 mg/kg	55, Appendix E, p. 283; 59, p. 3
SMS-02-SD	Nickel	200 mg/kg	7.4 mg/kg	55, Appendix E, p. 283; 59, p. 3
SMS-02-SD	Zinc	560 J* (373.33) mg/kg	11 mg/kg	55, Appendix E, p. 283; 59, p. 3
SMS-03-SW	Copper	330 µg/L	60 µg/L	55, Appendix E, p. 310; 59, p. 11
SMS-03-SW	Cyanide	17 µg/L	15 µg/L	55, Appendix E, p. 321; 59, p. 11
SMS-03-SW	Lead	7.9 µg/L	5.0 µg/L	55, Appendix E, p. 310; 59, p. 11

TABLE 17: Analytical Results for Surface Water and Sediment Samples – April 2009				
Sample ID	**Hazardous Substance**	**Concentration**	**MRL**	**References**
SMS-03-SW	Mercury	0.20 µg/L	0.10 µg/L	55, Appendix E, p. 310; 59, p. 11
SMS-03-SD	Chromium	94 mg/kg	1.4 mg/kg	55, Appendix E, p. 287; 59, p. 3
SMS-03-SD	Copper	560 mg/kg	3.6 mg/kg	55, Appendix E, p. 287; 59, p. 3
SMS-03-SD	Nickel	110 mg/kg	5.8 mg/kg	55, Appendix E, p. 287; 59, p. 3
SMS-03-SD	Zinc	350 J* (233.33) mg/kg	8.7 mg/kg	55, Appendix E, p. 287; 59, p. 3

Notes:

*	Estimated concentration with an unknown bias
( )	Concentration was adjusted in accordance with Reference 82.
µg/L	Micrograms per liter
ID	Identification
J	The concentration is estimated, but the presence of the analyte is not in doubt.
mg/kg	Milligrams per kilogram
MRL	Minimum reporting limit
SD	Sediment
SMS	Smokey Mountain Smelters
SW	Surface water

Attribution

The SMS property is located at 1508 Maryville Pike in Knoxville, Tennessee. From 1922 until at least 1948, Knoxville Fertilizer Company operated a fertilizer factory on the SMS property. Structures on the property included: sulfuric acid tank, 30,000-gallon water tank, 70,000-gallon reservoir, and nitre house (Refs. 5, pp. 1, 4; 30, p. 1; 64). U.S. patents written by assignors to Knoxville Fertilizer Company describe the production processes for phosphatic and ammonium sulphate fertilizers. Both of these fertilizers utilize acid phosphate (super-phosphate) (Refs. 10, p. 1; 11). Manufacturing of phosphate fertilizer produces wastewater, which may contain heavy metals (cadmium, mercury, lead), total phosphorus, ammonia, fluorides, and chemical oxygen demand (Ref. 29, p. 6). Drainage from stockpiles of gypsum may contain heavy metals (cadmium, mercury, and lead), fluorides, and phosphoric acid (Ref. 29, p. 5). Knox County tax assessor information indicates that ownership of the property changed numerous times between 1948 and 1979; however, operations on the property may have continued in manufacturing agricultural products such as fertilizer (Ref. 5, pp. 4, 5).

SMS (also known as Rotary Furnace, Inc.) was established in 1979 (Ref. 32, p. 1). Limited information is available regarding the operational history at the SMS property. According to a 1985 KCDAPC permit to operate a potential air contaminant source, an aluminum furnace (Rotary Aluminum Recovery Furnace #1) operated on the SMS property (Refs. 5, p. 5; 49). From 1983 to 1989, KCDAPC received complaints regarding open burning and heavy emissions from the facility. Numerous inspections were performed at the property, and violations were issued for open burning and excessive emissions (Refs. 28; 33; 34). In a lease executed on October 1, 1982, Rotary Furnace was allowed to bury slurry generated by the operation of its rotary furnace on the property (Ref. 7, pp. 9, 14).

In March 1983, the Tennessee Division of Solid Waste Management conducted an inspection at the SMS property regarding the operation of an unpermitted landfill/disposal area on the property (Refs. 26; 27; 35). During the inspection, the landfill (dump) contained demolition and industrial waste (slag and cinders from furnace operations). The dump also contained evidence of burning waste (Refs. 26; 35). In August 1983, the Tennessee Division of Solid Waste Management conducted a geologic evaluation at the SMS property. During the evaluation, the landfill/disposal area contained mostly impure “salt cake” resulting from processing aluminum ore (Ref. 36, p. 1). Based on the location of the landfill/disposal area and the exterior waste pile (Source No. 1), the landfill/disposal area appears to have been located in the same location as the Source No. 1 waste pile (Refs. 36, pp. 3, 4; 55, Appendix A, Figure 2, p. A-2) (see Figure 2 of this documentation record). Upon subsequent evaluation and observation, it appears that the landfill/disposal area consists of two different types of waste: the overlying waste pile and the underlying mixed-waste disposal area. The overlying waste pile (Source No. 1) consists of homogenous fine gray aluminum smelter waste that is similar in appearance to the interior waste piles (Source No. 2) (Refs. 4, pp. 1, 56, 103 through 127; 46; 55, p. 4; 55, Appendix D, p. 4). This waste pile is located on top of what appears to be a mixed-waste disposal area with some evidence that backfill material may have been contemporaneously placed among the underlying mixed waste. Borings show that wastes in the underlying mixed-waste disposal area include smelter waste that is commingled with mixed waste including paper and wood fragments, broken white and red brick fragments, angular limestone, gravel, clay, and silty clay (Ref. 4, pp. 36, 103 through 127).

Source No. 1 (exterior waste pile) is approximately 3.3 acres (143,748 square feet) and unnaturally devoid of vegetation; it contains secondary aluminum smelter waste with a mostly gray, fine, silty texture (Refs. 4, p. 56; 39; 46; 55, p. 4; 55, Appendix B, Table 1C, p. B-4; 55, Appendix D, p. 4) (see Figure 2 of this HRS documentation record). Source No. 2 (interior waste piles) is about 1,653.97 yd^3 and consists of two primary aluminum smelter waste piles located inside the process building (Refs. 55, Appendix A, Figure 3, p. A-3; 65; 78, p. 3) (see Figure 2 of this HRS documentation record). The process building has no

floors, and holes have formed in the walls and ceiling (Refs. 55, p. 4, Appendix C, pp. C-1, C-2; 76, pp. 1, 5, 8).

Source No. 2 (interior waste piles) contain gray material (aluminum smelting waste) similar in appearance to the waste contained in Source No. 1 (exterior waste pile) (Refs. 4, p. 1; 55, p. 4). Reactivity tests conducted on the waste contained in Source No. 2 indicate that the waste is capable of generating ammonia and hydrogen cyanide (Ref. 78, pp. 3, 6, 7).

Waste generated from aluminum smelters such as the one operated at SMS includes pot line scrubber sludge, pot line skimmings, spent potliners, and cast house dust (Ref. 40, p. 256). Residuals from metal smelting and refining industries include arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc (Ref. 40, p. 255). These hazardous substances were detected in samples collected from Source Nos. 1 and 2 (see Tables 2, 3, 6, and 7 of this HRS documentation record). Polycyclic aromatic hydrocarbons (PAHs) such as those detected in samples collected from Source No. 1 are emitted from aluminum smelting activities and are found in smelter residues (Refs. 41, p. 1; 42, pp. 2-2, 3-3; 53, p. 4) (see Table 2 of this documentation record).

Analytical results of source samples collected from Source Nos. 1 and 2 between October 2006 and April 2009 indicated hazardous substances related to aluminum smelting operations including arsenic, cadmium, chromium, copper, cyanide, lead, mercury, zinc, acetone, 2-butanone, benzo(a)pyrene, and PCBs among others (see Tables 2, 3, 6, and 7 in Section 2.2.2 for Source Nos. 1 and 2 of this HRS documentation record). Also antimony, arsenic, chromium, copper, cyanide, lead, mercury, nickel, zinc, acetone, and 2-butanone have been documented as meeting observed release criteria in surface water or sediment samples collected from the unnamed perennial tributary of the East Branch of Flenniken Branch (see Tables 11, 13, 15, and 17 in Section 4.1.2.1.1, Observed Release, of this HRS documentation record).

Several leachate seeps are located on the southern end of Source No. 1 (exterior waste pile). Two of the seeps have been sampled during previous investigations (Ref. 46). In 2001, collocated surface water and sediment samples were collected from the most eastern leachate seep (main leachate seep). The samples contained arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc (Ref. 5, pp. 413, 414, 415). In 2006 and 2009, a leachate seep (located about 50 feet west of the main leachate seep) was observed flowing into the unnamed perennial tributary of the East Branch of Flenniken Branch (Refs. 4, p. 2; 46; 55, p. 4; 73; 74; 76). During the 2009 integrated assessment conducted by START and REAC, the leachate seep was orange in color (Refs. 55, p. 4; 74). Samples collected from the leachate seep contained arsenic, chromium, copper, lead, nickel, zinc, and 2-butanone (Refs. 4, pp. 1, 2, 26, 29, 36, 159, 178, 326, 345; 55, Appendix A, Figure 3, p. A-3; 55, Appendix D, p. 18).

The analytes detected in the leachate seep samples were also detected in samples collected from Source Nos. 1 and 2 and samples collected from the unnamed perennial tributary of the East Branch of Flenniken Branch (see Tables 2, 3, 6, and 7 of this HRS documentation record).

Other potential sources of contamination exist in the vicinity of the SMS property (Ref. 54, pp. i, 1, 2). The Screen Arts site consists of 2 parcels of land located on the western side of Maryville Pike, which is southwest of the SMS property. The Witherspoon Landfill site consists of five parcels of land located directly south of the SMS property. Surface water runoff from these two sites enters Flenniken Branch downstream of the SMS property (Ref. 54, pp. i, 2). Therefore, runoff from Screen Arts and Witherspoon Landfill does not impact the locations where observed releases have been documented immediately downstream of the SMS property (Refs. 54, p. 2; 55, Appendix A, Figure 3, p. A-3 and Figure 4, p. A-4).

The hazardous substances listed below have been documented in Source Nos. 1 and 2 as well as in the unnamed perennial tributary of the East Branch of Flenniken Branch, indicating the migration of

hazardous substances from the sources (see Tables 2, 3, 6, and 7 in Section 2.2.2 for Source Nos. 1 and 2; and Tables 11, 13, 15, and 17 in Section 4.1.2.1.1, Observed Release, of this HRS documentation record).

Hazardous Substances Released:

Antimony
Arsenic
Chromium
Copper
Cyanide
Lead
Mercury
Nickel
Zinc
Acetone
2-butanone

Surface Water Observed Release Factor Value: 550
(Ref. 1, Section 4.1.2.1.1)

4.1.2.2 DRINKING WATER THREAT WASTE CHARACTERISTICS

4.1.2.2.1 Toxicity/Persistence

Table 18 summarizes the toxicity and persistence factor values for the hazardous substances detected in the source samples (see Tables 2, 3, 6, and 7 of this HRS documentation record) with containment factor values greater than zero. The combined toxicity and persistence factor values are assigned in accordance with Reference 1, Section 4.1.2.2.1.

TABLE 18: Surface Water Toxicity/Persistence

Hazardous Substance	Source No.	Toxicity Factor Value	Persistence Factor Value	Does Hazardous Substance Meet Observed Release? (Yes/No.)	Toxicity/ Persistence Factor Value (Ref. 1, Table 4-12)	Reference
Acetone	1	1	0.07	Yes	0.07	2, p. BI-1
Antimony	2	10,000	1	Yes	10,000	2, p. BI-1
Anthracene	1	10	0.4	No	4	2, p. BI-1
Arsenic	1, 2	10,000	1	Yes	10,000	2, p. BI-1
Acenaphthene	1	10	0.4	No	4	2, p. BI-1
Benzo(a)anthracene	1	1,000	1	No	1,000	2, BI-2
Benzo(g,h,i) perylene	1	0	1	No	0	2, p. BI-2
Benzo(k)fluoranthene	1	100	1	No	100	2, p. BI-2
Benzo(a)pyrene	1	10,000	1	No	10,000	2, p. BI-2
Beryllium	1, 2	10,000	1	No	10,000	2, p. BI-2
2-Butanone (methyl ethyl ketone)	1	1	0.4	Yes	0.4	2, p. BI-8
Butyl benzyl phthalate	1	10	1	No	10	2, p. BI-2
Cadmium	1, 2	10,000	1	No	10,000	2, p. BI-2
Chromium	1, 2	10,000	1	Yes	10,000	2, p. BI-3
Chrysene	1	10	1	No	10	2, p. BI-3
Copper	1, 2	0	1	Yes	0	2, p. BI-3
Cyanide	2	100	1	Yes	100	2, p. BI-4
Indeno(1,2,3-cd)pyrene	1	1,000	1	No	1,000	2, p. BI-8
Fluorene	1	100	1	No	100	2, p. BI-6

TABLE 18: Surface Water Toxicity/Persistence						
Hazardous Substance	**Source No.**	**Toxicity Factor Value**	**Persistence Factor Value**	**Does Hazardous Substance Meet Observed Release? (Yes/No.)**	**Toxicity/ Persistence Factor Value (Ref. 1, Table 4-12)**	**Reference**
Lead	1, 2	10,000	1	Yes	10,000	2, p. BI-8
Mercury	1, 2	10,000	1	Yes	10,000	2, p. BI-8
Naphthalene	1	1,000	0.4	No	400	2, p. BI-9
Nickel	1, 2	10,000	1	Yes	10,000	2, p. BI-9
Phenanthrene	1	0	0.4	No	0	2, p. BI-9
Polychlorinated biphenyls	1	10,000	1	No	10,000	2, p. BI-10
Pyrene	1	100	1	No	100	2, p. BI-10
Silver	1, 2	100	1	No	100	2, p. BI-10
Zinc	1, 2	10	1	Yes	10	2, p. BI-12

Notes:

Polychlorinated biphenyls include Aroclor-1232 and Aroclor-1260.
NA Not available

Toxicity/Persistence Factor Value: 10,000
(Ref. 1, Section 4.1.2.2.1.3)

4.1.2.2.2 Hazardous Waste Quantity

TABLE 19: Hazardous Waste Quantity		
Source No.	**Source Type**	**Source Hazardous Waste Quantity**
1	Waste Pile	11,057.53
2	Waste Pile	661.58

Total Source Hazardous Waste Quantity Value = 11,719.11

The hazardous constituent quantity for Source No. 1 (exterior waste pile) is not adequately determined. The estimated area of Source No. 1 is 3.3 acres (143,748 square feet) (Ref. 39).

The hazardous constituent quantity for Source No. 2 (interior waste piles) is not adequately determined. The estimated volume of Source No. 2 is 1,653.97 yd^3 (44,657.325 ft^3) (Ref. 65).

HWQ Factor Value: 10,000
(Ref. 1, Section 2.4.2.2, Table 2-6)

4.1.2.2.3 Waste Characteristics Factor Category Value

The waste characteristics factor category value was obtained by multiplying the toxicity/persistence and HWQ factor values, subject to a maximum product of 1×10^8. Based on this product, a value was assigned in accordance with Reference 1, Table 2-7.

Toxicity/Persistence Factor Value: 10,000
HWQ Factor Value: 10,000

Toxicity/Persistence Factor Value × HWQ Factor Value: 1×10^8

Waste Characteristics Factor Category Value: 100
(Ref. 1, Table 2-7)

4.1.2.3 DRINKING WATER THREAT TARGETS

No surface water intakes are located within the 15-mile TDL downstream of the SMS property (Refs. 25; 45).

4.1.2.3.3 Resources

The Fort Loudoun Reservoir is used for recreational activities including boating and fishing (Refs. 24, pp. 1 through 4; 69; 75; 76, p. 2). The I.C. King Park is located at the point where Flenniken Branch empties into the Fort Loudoun Reservoir on the Tennessee River. Public fishing and boat ramps are located at I.C. King Park (Refs. 76, p. 2; 80, pp. 1, 6 through 9).

Resources Factor Value: 5.00
(Ref. 1, Section 4.1.2.3.3)

4.1.3.2 HUMAN FOOD CHAIN THREAT WASTE CHARACTERISTICS

4.1.3.2.1 Toxicity/Persistence/Bioaccumulation

Table 20 summarizes the toxicity/persistence and bioaccumulation factor values for hazardous substances detected in the source samples with containment factor values exceeding zero. The combined toxicity, persistence, and bioaccumulation factor values are assigned in accordance with Reference 1, Section 4.1.3.2.1.

TABLE 20: Toxicity/Persistence/Bioaccumulation

Hazardous Substance	Source No.	Toxicity Factor Value	Persistence Factor Value*	Bio-Accumulation Value**	Toxicity/ Persistence/ Bioaccumulation Factor Value (Ref. 1, Table 4-16)	References
Acetone	1	1	0.07	0.5	0.035	2, p. BI-1
Antimony	2	10,000	1	5	50,000	2, p. BI-1
Anthracene	1	10	0.4	50,000	2×10^5	2, p. BI-1
Arsenic	1, 2	10,000	1	5	50,000	2, p. BI-1
Acenaphthene	1	10	0.4	500	2,000	2, p. BI-1
Benzo(a)anthracene	1	1,000	1	50,000	5×10^7	2, BI-2
Benzo(g,h,i) Perylene	1	0	1	50,000	0	2, p. BI-2
Benzo(k)fluoranthene	1	100	1	50,000	5×10^6	2, p. BI-2
Benzo(a)pyrene	1	10,000	1	50,000	5×10^8	2, p. BI-2
Beryllium	1, 2	10,000	1	50	5×10^5	2, p. BI-2
2-Butanone (methyl ethyl ketone)	1	1	0.4	0.5	0.2	2, p. BI-8
Butyl benzyl phthalate	1	10	1	500	5,000	2, p. BI-2
Cadmium	1, 2	10,000	1	5,000	5×10^7	2, p. BI-2
Chromium	1, 2	10,000	1	500	5×10^6	2, p. BI-3
Chrysene	1	10	1	5	50	2, p. BI-3
Copper	1, 2	0	1	500	0	2, p. BI-3
Cyanide	2	100	1	0.5	50	2, p. BI-4

TABLE 20: Toxicity/Persistence/Bioaccumulation						
Hazardous Substance	**Source No.**	**Toxicity Factor Value**	**Persistence Factor Value***	**Bio-Accumulation Value****	**Toxicity/ Persistence/ Bioaccumulation Factor Value (Ref. 1, Table 4-16)**	**References**
Indeno(1,2,3-cd)pyrene	1	1,000	1	50,000	5×10^7	2, p. BI-8
Fluorene	1	100	1	500	50,000	2, p. BI-6
Lead	1, 2	10,000	1	5	50,000	2, p. BI-8
Mercury	1, 2	10,000	1	50,000	5×10^8	2, p. BI-8
Naphthalene	1	1,000	0.4	50,000	2×10^7	2, p. BI-9
Nickel	1, 2	10,000	1	0.5	5,000	2, p. BI-9
Phenanthrene	1	0	0.4	5,000	0	2, p. BI-9
Polychlorinated biphenyls	1	10,000	1	50,000	5×10^8	2, p. BI-10
Pyrene	1	100	1	50,000	5×10^6	2, p. BI-10
Silver	1, 2	100	1	50	5,000	2, p. BI-10
Zinc	1, 2	10	1	5	50	2, p. BI-12

Notes:

* Persistence value for rivers
** Bioaccumulation factor value for freshwater

Toxicity/Persistence/Bioaccumulation Factor Value: 5×10^8
(Ref. 1, Section 4.1.3.2.1.4)

4.1.3.2.2 Hazardous Waste Quantity

Table 21 lists HWQs for the sources.

TABLE 21 – Hazardous Waste Quantity		
Source No.	**Source Type**	**Source Hazardous Waste Quantity**
1	Waste Pile	11,057.53
2	Waste Pile	661.58

Total Source Hazardous Waste Quantity Value = 11,719.11

The hazardous constituent quantity for Source No. 1 (exterior waste pile) is not adequately determined. The estimated area of Source No. 1 is 3.3 acres (143,748 square feet) (Ref. 39).

The hazardous constituent quantity for Source No. 2 (interior waste piles) is not adequately determined. The estimated volume of Source No. 2 is 1,653.97 yd^3 (44,657.325 ft^3) (Ref. 65).

HWQ Factor Value: 10,000
(Ref. 1, Section 2.4.2.2)

4.1.3.2.3 Waste Characteristics Factor Category Value

The waste characteristics factor category was obtained by multiplying the toxicity/persistence and HWQ factor values, subject to a maximum product of 1×10^8. Then this product was multiplied by the bioaccumulation potential factor value, subject to a maximum product of 1×10^{12}. Based on this product, a value was assigned in accordance with Reference 1, Table 2-7.

Toxicity/Persistence Factor Value: 10,000
HWQ Factor Value: 10,000

Toxicity/Persistence Factor Value ×
HWQ Factor Value: 1×10^8

Toxicity/Persistence Factor Value ×
HWQ Factor Value × Bioaccumulation Factor Value (50,000): 5×10^{12}

Waste Characteristics Factor Category Value: 1,000
(Ref. 1, Table 2-7)

4.1.3.3 HUMAN FOOD CHAIN THREAT TARGETS

4.1.3.3.1 Food Chain Individual

As noted in Section 4.1.2.1.1, an observed release of hazardous substances having a bioaccumulation factor value of 500 or greater is documented in the unnamed tributary of the East Branch of Flenniken Branch (see Tables 10 to 17 of this HRS documentation record). In June 1999, November 2001, and March 2006, evidence of fishing was observed on the East Branch of Flenniken Branch, just upstream of Flenniken Branch (Refs. 76; 80, pp. 1, 4, 5). Information obtained from the Tennessee Wildlife Resources Commission indicates that fishing for human consumption occurs in the Fort Loudoun Reservoir and on the Tennessee River, which are within the 15 mile surface water migration pathway TDL (Refs. 3; 24; 75). These water bodies are downstream of surface water and sediment sampling locations on the unnamed perennial tributary of the East Branch of Flenniken Branch (Refs. 23, pp. 1, 16; 69; 76). Fish caught and consumed from the Fort Loudoun Reservoir and the Tennessee River within the 15 mile surface water migration pathway TDL include smallmouth, largemouth, striped, and black bass; channel catfish; crappie; black crappie; and white crappie (Refs. 69; 75). The I.C. King Park is located at the point where Flenniken Branch empties into the Fort Loudoun Reservoir on the Tennessee River. Public fishing and boat ramps and piers are located at I.C. King Park (Refs. 76, p. 2; 80, pp. 1, 6, 8, 9).

Sample ID: SW-Stream/182-0061 Strm
Level I/Level II/Potential: Potential
Hazardous Substances: Acetone, 2-Butanone, arsenic, copper, mercury
Bioaccumulation Potential: 50,000

Sample ID: SMS-02-SW
Level I/Level II/Potential: Potential
Hazardous Substances: Arsenic, copper, lead, mercury, zinc
Bioaccumulation Potential: 50,000

Sample ID: SMS-02-SD
Level I/Level II/Potential: Potential
Hazardous Substances: chromium, copper
Bioaccumulation Potential: 500

Sample ID: SMS-03-SW
Level I/Level II/Potential: Potential
Hazardous Substances: copper, lead, mercury
Bioaccumulation Potential: 50,000

Sample ID: SMS-03-SD
Level I/Level II/Potential: Potential
Hazardous Substances: Chromium, copper
Bioaccumulation Potential: 500

References: 2, pp. BI-1, BI-3, BI-8, BI-12; 4, pp. 35, 155, 326; 55, Appendix A, Figure 3, p. A-3; 55, Appendix E, pp. 283, 287, 308, 310

Due to the observed release of hazardous substances having a bioaccumulation factor value of 500 or greater in the unnamed tributary of the East Branch of Flenniken Branch, and a downstream fishery within the 15-mile target distance limit, a food chain individual factor value of 20 is assigned (Ref. 1, Section 4.1.3.3.1).

TABLE 22: FOOD CHAIN INDIVIDUAL			
Identity of Fishery	**Type of Surface Water Body**	**Dilution Weight (Ref. 1, Table 4-13)**	**References**
Fort Loudoun Reservoir on the Tennessee River	Large River	0.0001	1, Table 4-13; 23, pp. 1, 6; 24; 44; 69; 75; 76

Food Chain Individual Factor Value: 20 (Ref. 1, Section 4.1.3.3.1)

4.1.3.3.2 Population

4.1.3.3.2.1 Level I Concentrations

No Level I samples were collected.

4.1.3.3.2.2 Level II Concentrations

No Level II samples were collected.

4.1.3.3.2.3 Potential Human Food Chain Contamination

Evidence of fishing, including fishing poles, was observed on the East Branch of Flenniken Branch about 0.75 mile downstream of the SMS property (Refs. 3; 76, p. 2; 80, pp. 1, 4, 5). Evidence of fishing, including bait cups, has been observed along the banks of Flenniken Branch in the I.C. King Park (Ref. 80, pp. 2, 3). Also, fishing piers and boat ramps are located on Flenniken Branch in I.C. King Park upstream of the Fort Loudoun Reservoir, about 2 miles downstream of the SMS property (Refs. 3; 76, p. 2; 80, pp. 1, 6, 8, 9). Fishing for human consumption occurs on the Fort Loudoun Reservoir about 2.3 miles downstream of the SMS property (Refs. 3; 69, p. 1; 75). The amount of fish caught on an annual basis is not known.

The flow rate of Flenniken Branch is not available (Ref. 70). The estimated flow rate for the Tennessee River at the Fort Loudon dam is about 43,061 cubic feet per second (Ref. 44). Information is not available on the annual production of fish caught in the Fort Loudoun Reservoir. Therefore, because the Fort Loudoun Reservoir on the Tennessee River is a fishery, the annual production is undetermined but greater than zero (Refs. 24, p. 1; 69; 75; 76, p. 2).

TABLE 23: POTENTIAL POPULATION TARGETS							
Identity of Fishery	**Annual Production (pounds)**	**Type of Surface Water Body**	**Average Annual Flow (cfs)**	**Population Value (P_i) (Ref. 1, Table 4-18)**	**Dilution Weight (D_i) (Ref. 1, Table 4-13)**	**$P_i \times D_i$**	**Refs.**
Fort Loudoun Reservoir on the Tennessee River	>0	Large River	43,061	0.03	0.0001	0.000003	3; 44; 75; 76, p. 2

Notes:

cfs Cubic feet per second

For the potential human food chain contamination factor value the sum of $P_i \times D_i$ is divided by 10.

Potential Human Food Chain Contamination Factor Value: 0.0000003
(Ref. 1, Section 4.1.3.3.2.3)

4.1.4 Environmental Threat

The environmental threat was not scored because it is not expected to contribute significantly to the overall score.